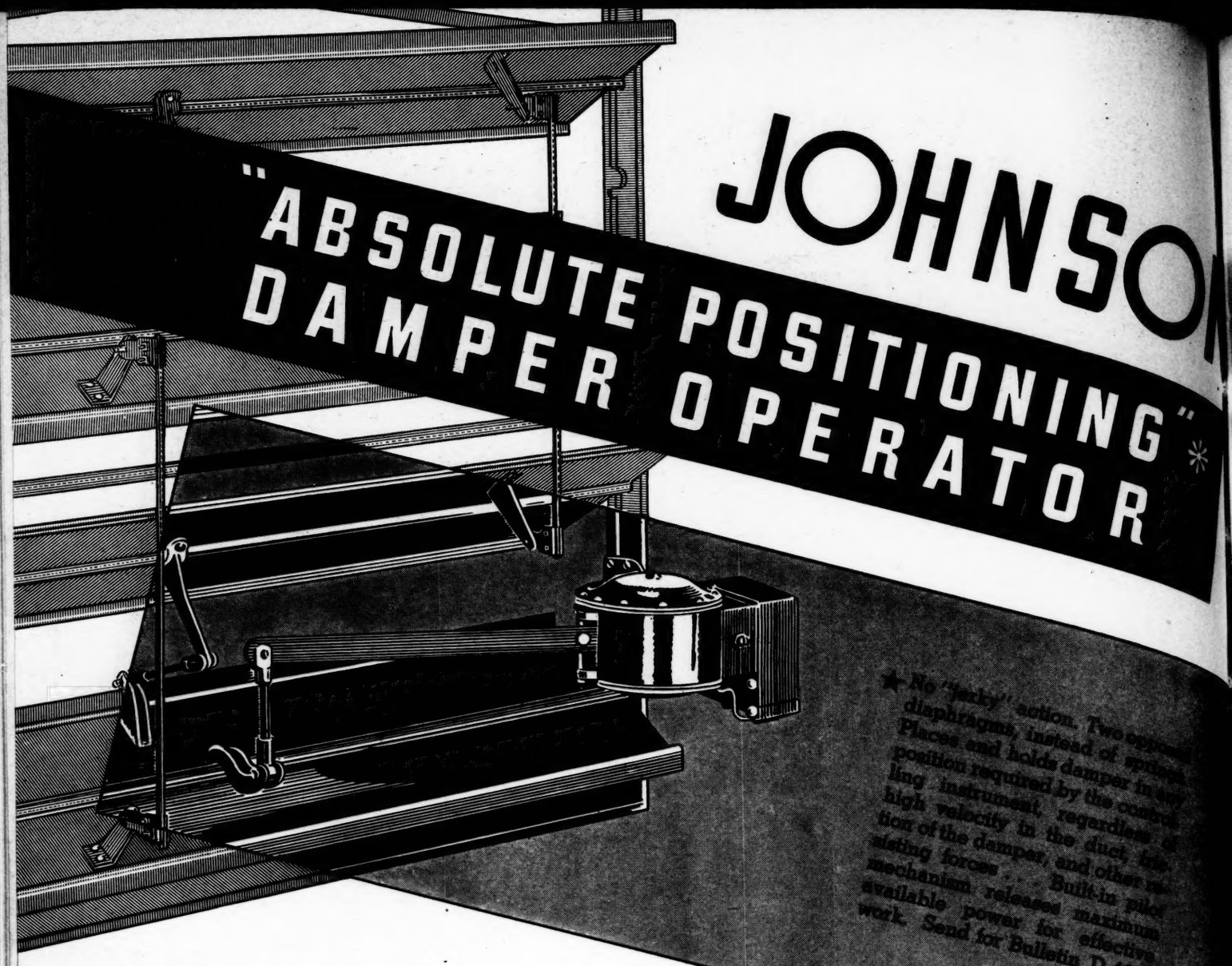
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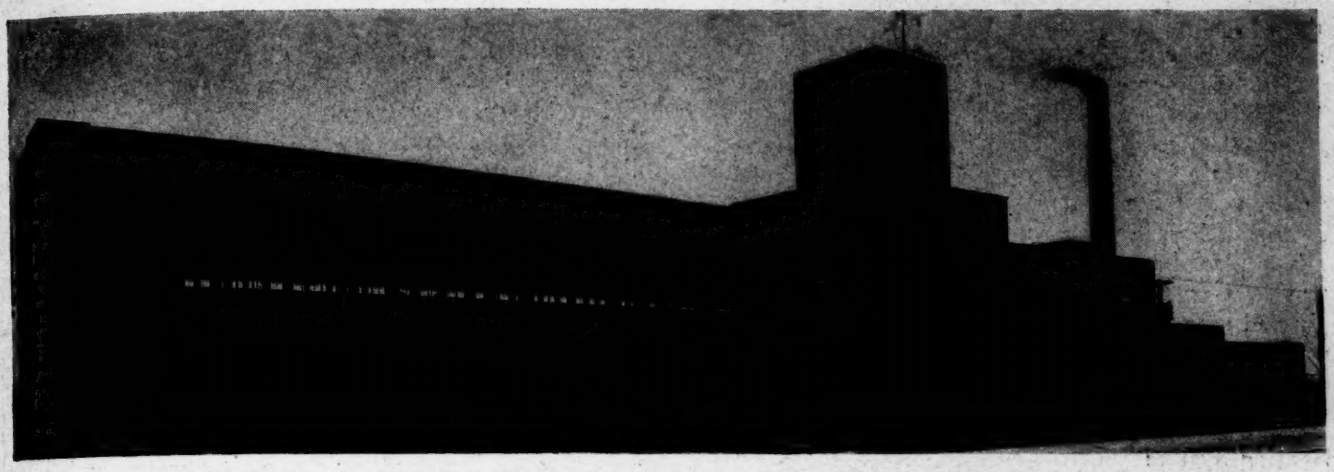
DAMPER OPERATOR
★ No "jerky" action. Two opposed diaphragms, instead of springs. Places and holds damper in any position required by the controlling instrument, regardless of high velocity in the duct, friction of the damper, and other resisting forces . . . Built-in pilot mechanism releases maximum available power for effective work. Send for Bulletin D-401.

Damper shown is Johnson "proportioning" type. Adjacent blades rotate in opposite directions, reducing quantity of air flowing, with little variation in velocity and no change of direction.
Bulletin D-225

Johnson has met the requirements of the air conditioning industry. The devices shown above are typical of many that have been developed especially fo

Johnson Automatic Control Systems for all types of Air Conditioning

The Johnson Service Company is a single, nation-wide organization engaged i just one line of business — the design, manufacture and installation of complet automatic temperature and humidity **CONTROL SYSTEMS.**



New plant of the Burroughs Adding Machine Co., Plymouth, Mich. The ground floor measures 170 x 600 ft.

Factory Building Heated by Condenser Cooling Water

By F. O. JORDAN†

The modern factory must watch all its operating costs. Here is a case where a large factory building is heated by a forced hot water system for which the heat is supplied largely by the turbine exhaust. An unusual feature is that the circulating water is passed through the turbine condensers.

AS a rule the annual cost of heating a large factory building runs into a considerable figure. Since factory operating costs must be thrown into the face of highly competitive markets as increased selling price of the product which is made by the factory, and since they ultimately are reflected in the annual balance sheet as reduced profits, any important reduction in heating costs is of vital interest. Not only must this be true from the heating engineer's viewpoint, but also from the viewpoint of the management, of the sales executives, the stockholders, and in fact of everyone affected by the factory or by the cost of its product, even including the buying public as well.

In the ultra-modern five-story manufacturing building recently put into operation by the Burroughs Adding Machine Company near Detroit, the operating cost of heating even in this northern climate has been practically eliminated by the unique design—a design noteworthy because it makes use of the waste heat in turbine condenser cooling water for maintenance of winter comfort for the employes.

Selection of Type of System

The occupancy conditions in this plant where adding machines are fabricated and assembled are quite different from those generally encountered in factory work. For the delicate nature of the product necessitates exceedingly painstaking methods which are entirely devoid of the element of physical exertion inherent in most factory labor. Therefore, the employes for the most part carry out their work while sitting, so that the same heating methods are required for employe comfort as are conventionally employed in the heating of general offices where the occupants are comparatively inactive.

Owing to the long, narrow shape and moderate ceiling height of the manufacturing areas, as well as to the fact that most of the occupants are sitting, either unit heaters or a blast system were deemed inadvisable because of the possibility of drafts under these particular conditions.

Therefore direct radiation was selected as being best suited to this installation.

Hot water under forced circulation was given preference over steam as the heating medium for the following reasons:

A.—The use of condenser water for heating of the building rather than exhaust steam from the steam turbines allows considerably lower back pressures against the turbines, especially in mild weather when moderate water temperatures suffice for heating.

B.—In a building of this extent requiring so great a number of radiators, the relative freedom from service of a hot water system was one of the deciding factors.

C.—No covering is required on piping throughout the building.

D.—The use of hot water permits very even control of temperature because of the fact that water temperature may so readily be varied to suit outside weather conditions.

E.—Since radiators in the forced hot water system may be located lower than the return mains, use of hot water eliminates the necessity of underground returns for first-floor radiators. This consideration was of special importance because there is no basement under the greater portion of the building.

The building is of a type which is rather unusual in modern factory construction, as it is a five-story reinforced concrete structure with brick and stone facing,

†Consulting engineer, Detroit.

rather than of the one-story monitor or saw-tooth construction now conventional for large factories.

The first-floor plan of the building is approximately 170 ft. by 600 ft., while the floors above the first are about 60 ft. wide by 600 ft. long.

The main building is connected by an underground tunnel with the power house, wherein electric current, compressed air, and steam are generated.

The plant has been laid out to accommodate an extensive program of expansion, as 18-in. hot water supply and recirculating mains have been run through the main tunnel ready for extension to four future buildings which are contemplated to be of the same size as the structure just completed.

Heating System

As stated, the entire heating system is of the two-pipe hot water variety with forced circulation. The main hot water supply feeder is run from the tunnel up to the fifth-story ceiling, where the supply main is installed, feeding through downfeed risers to the radiators. The return risers from the radiators drop down to the return main which is installed at the first-story ceiling, so that the first-floor radiators are below the return main. All radiators are provided with supply and return connections, both connections generally being made at the same end of the radiator. Although most of the radiators are about six feet long, all radiators heat uniformly throughout their entire length.

With the exception of a few locations where unit heaters could be used, the entire building is heated by direct wall-hung cast iron radiators, with a few concealed copper radiator units on the first floor. Approximately seven hundred radiators are installed, the average unit containing roughly 100 sq. ft. of surface. Since all radiators are below the level of the supply main, automatic air traps are not required on the individual radiators, the supply connections being arranged to vent any entrained air upward to the supply risers, and then to the overhead supply mains. Automatic air traps are provided at the high points of the supply mains to discharge any air from the system. An open expansion tank is installed in a tower which projects above the roof.

An air supply system is installed for the gymnasium, which draws in outside air and heats it somewhat above room temperature. The remainder of the building is not supplied with outside air by mechanical means, as the high ratio of window to floor area insures sufficient outside air for the occupants by infiltration, or by opening of windows.

Heat losses were calculated in the usual manner, infiltration being based upon one complete air change per hour.

Radiators were selected upon the basis of 200 B.t.u. per sq. ft. per hr., with water entering the radiators at 190F and leaving them at 170F under extreme load conditions. Generally, the entering water temperature required is considerably below this figure, so that lower temperatures are used, with resultant reduction in back pressure against the turbines.

The total water friction head on the system is 75 ft., including pressure drop through piping, radiators, and condensers. Of this friction, about 60 ft. are made up of pipe friction which is distributed over the total circuit length of about 2200 ft., so that the average friction is about 30 in. per 100 ft. of equivalent run.

In addition to furnishing heat for the factory building, the power house also provides electric power and light, compressed air and steam for process work.

Steam is generated at 450 lb. and 600F by two boilers rated at 50,000 lb. per hr. of steam each. The boilers are equipped with water walls, economizers, and superheaters. Coal is used as fuel, being burned by spreader type stokers under forced draft. Complete automatic combustion control is installed to correlate fuel and air supply in the best proportions with steam demand.

Instruments for checking boiler performance include pressure gages, steam flow meters, draft indicators, and recorders for CO_2, and for steam, feed water, and flue gas temperatures. Both steam and electric motor-driven auxiliaries are installed. Automatic coal feeding and ash handling equipment is provided, as well as fly ash and clinker collectors.

As mentioned, the condensers for the turbo-generators are used as heat exchangers during the heating season, so that condenser cooling water is circulated through the factory building heating system. The circulating pumps for heating service are located adjacent to the condensers. When no heat is required in the building, the condenser cooling water is circulated through an evaporative cooling tower.

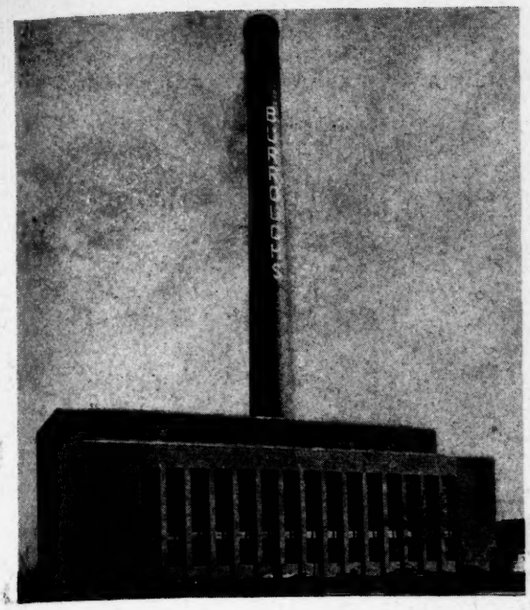
In addition to the high pressure steam system, there are two other steam systems, one at 6-lb. pressure and one at 50-lb. pressure. The 6-lb. system is used for delivering the exhaust from the steam-driven auxiliaries to a deaerating type feed water heater for heating the boiler feed water. A 6-lb. steam bleeder connection is made from the turbines into this system to provide steam for heating feed water when the electric motor-driven auxiliaries are in use. The 50-lb. system is used for certain manufacturing processes.

A unique use of a surface type evaporator is made. Instead of a pressure reducing valve for reducing steam pressure from the 450-lb. 600F steam system to the 50-lb. steam system, water is supplied from a feed water heater at 200 to 210F to the evaporator, where it is evaporated at 50-lb. pressure by steam admitted to a heating coil in the evaporator, from the high pressure steam system. The high-pressure steam supply connection is provided with a pressure regulating valve whose setting is controlled by the pressure of the 50-lb. system. With this arrangement the evaporating rate of the evaporator is regulated so that 50-lb. pressure is maintained in the 50-lb. pressure system by regulation of steam pressure in the high pressure evaporating coil.

The use of the evaporator in this manner obviates the necessity of a desuperheater which would be required if high-temperature steam were admitted directly into the 50-lb. pressure system through a pressure reducing valve.

A 50-lb. bleeder connection is made from the turbines to the 50-lb. steam system also.

The principal water supply for the feed water heater consists of condensate from the high-pressure evaporator coil, from the domestic hot water heaters, and from the auxiliary heaters which are installed for heating water for the forced hot water heating system when



(Left) Steam is generated at 450 lb. at power house by two boilers rated at 50,000 lb. per hr. each. (Right) In the left foreground is shown one of the turbo generators, while the boilers are visible at the right. Makeup water is less than 1% of the output.

the turbines and condensers are out of operation. Makeup water for this plant is less than 1% of the boiler output. The necessary makeup water is admitted automatically by a float valve in the feed water heater from the surge tank storing evaporator water.

The forced water heating system was filled from the deep well pumps. This may appear to be an innocent statement, but the deep well source of water supply for the system gave rise to an unusual, and for a time very puzzling, condition.

When the heating system was first placed in operation, the radiators toward the ends of the building on the top floor soon gave every evidence of being air bound, as they obstinately refused to heat. Although it did not seem possible that the trouble could be the result of air binding, because the arrangement of the piping should have permitted all radiators to vent themselves to the mains and then to the automatic air traps which are located at the high points of all runs, yet there was a loud and long hissing sound upon removal of the vent plugs from the afflicted radiators.

After being vented in this way, the radiators would perform satisfactorily for a time, each doing its full quota of heating. Then the same trouble would occur all over again. At one time, a lighted match was applied to the vent hole of a radiator when the plug was removed. Result—a long blue flame. Eventually, the troublemaker was found to be marsh-gas, and its origin was traced to the deep wells from which the system was filled. Subsequent trouble was entirely avoided by introducing water to the heating system, only after being thoroughly "degassed."

But the question still unanswered is—When the entire system relieves itself automatically of air to perfection, why was it unable to rid itself of this gas which is lighter than air!

Designing and Installation Concerns

The concerns which participated in this installation are: Architects and engineers, Albert Kahn, Inc., Detroit; heating contractor, Donald Miller Co., Detroit; power plant and tunnel piping contractor, Lorne Plumbing and Heating Co., Detroit; ventilating contractor, American Refrigerating Co., Detroit.

"Space Heating" Becomes "Direct Heating"

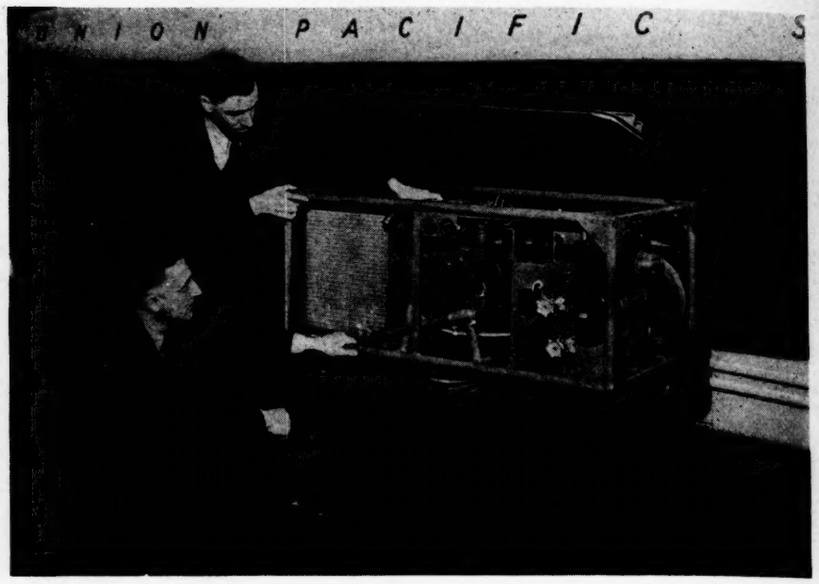
WITH the recent change in name of the Gas Space Heater Division of the Association of Gas Appliance and Equipment Manufacturers, a movement is under way in the gas industry to substitute and popularize the use of the term "direct heating" in place of what has heretofore been described as "space heating," reports the American Gas Association. This change in terminology has considerable support within the industry, where the term "space heating" has caused considerable confusion in the past.

When the regulations for testing gas appliances were originated, a name had to be selected to cover the large group of heating appliances other than boilers and furnaces. The name selected was "space heaters." It took many years before this term was in general use in the trade that was involved in selling gas heaters. Elsewhere the term has never been accepted.

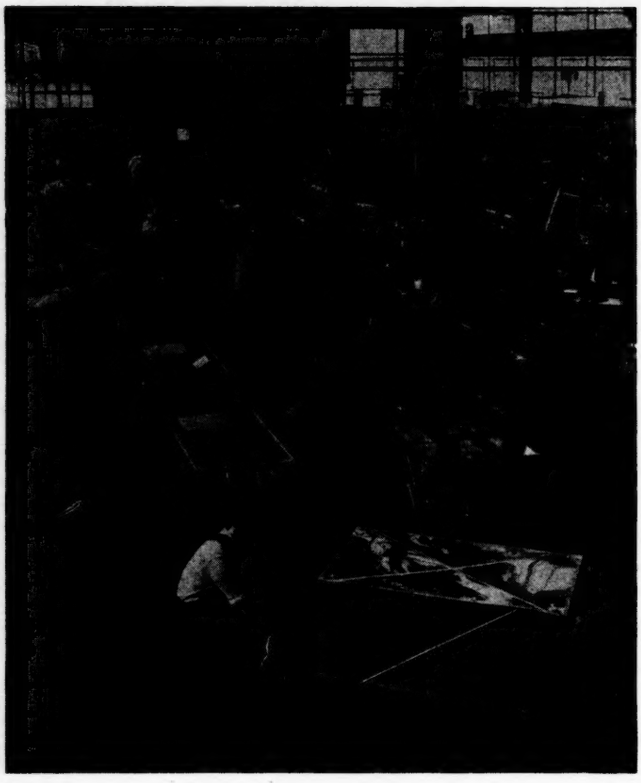
Architects, builders, and engineers usually use the term "space heating" to designate the heating of any given space, whether it is an office building or a modest dwelling. They use the term regardless of the type of equipment and the method of heating It appears logical that such use of the term "space heating" is correct.

During the past several years some portions of the industry have been using the terms "direct heating" and "direct heaters." These terms have attained considerable acceptance. In marketing circles the use of the words "direct heating" has aroused sales interest.

Fleet of Air Conditioned Buses in



Word of the first sizable installation of summer cooling equipment in buses is news. Here is a move into what has long been looked at as a highly desirable place for air conditioning. Buses rival the railroads in the territory they cover. They may be expected to rival them in providing air comfort for their passengers.



1 *The special bus unit contains the compact power engine, condenser, cooling unit. Its operation is controlled from a master station at the driver's seat. The self-powered, self-contained plant is mounted in a framework of welded aeroplane tubing. The vertical 4-cylinder compressor is moderate speed, roller-bearing equipped, full force lubrication, belt-driven from self-starting, governed engine. The condenser is of evaporative type, finned, with spray nozzles and motor-driven scavenger pump. Entire air conditioning installation weighs 1250 lb.*

This unusual picture shows the complete assembly process in the factory. At the right rear is shown the empty, tubular frame for the refrigerating power unit. Assembly proceeds step by step across the back row and up the front; note the completed unit at the right front, ready for installation in the bus.

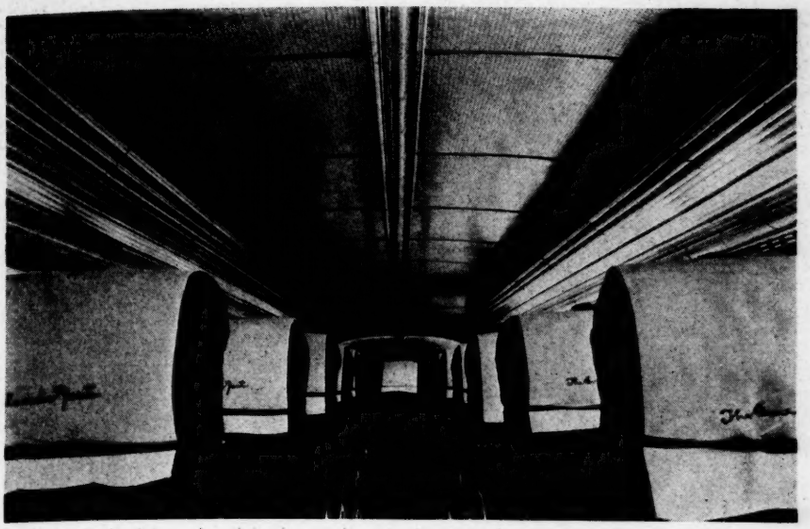
2 *Here is the completed unit ready for operation. Photo shows James Goggins (standing), air conditioning engineer for the Interstate Transit Lines, and Charles Knox, Baker chief engineer, inspecting one of the units. Flexible connections make inspection of the unit possible in this position, while still in operation, and the rubber treaded rollers absorb road shock. In its usual position the whole unit is rolled into the recess in the bus body, the demountable channel rails are removed, the door is closed and the cooled bus is all set to go places. The unit can be rolled out and removed altogether during cold weather, if desired.*

A fleet of air conditioned buses is now in regular service from Chicago and Kansas City to the Pacific Coast. The Interstate Transit Lines (Chicago and North Western Stages and Union Pacific Stages) have equipped 140 buses with year-round air conditioning similar to that used in modern business buildings. Cooling equipment is already in service on the route between Los Angeles and Salt Lake City, and buses on other main line routes are to be cooled as fast as hot weather arrives in those territories.

Cooling, however, is only one function performed by this bus air conditioning system. It also filters, deodorizes, dehumidifies, and circulates the air. During the winter, the air is heated instead of cooled. Two filters are employed. One removes dust, dirt and pollen while the second filter removes odors. Temperature inside the bus is regulated automatically by thermostatic control. The air inside the coach in summer is kept approximately 15F cooler than the outside temperature.

The inauguration of air conditioning in buses takes them another long step away from the "overgrown auto" concept of previous years. The most important previous departure from this concept was provided by the square-front rear-motored designs introduced during the last two or three years by several bus manufacturers. The new air conditioned Super-Coach establishes an entirely distinctive type of travel, and greatly enhances the comfort and pleasure of highway transportation.

West Carries Demountable Units



4 *(Left) Here is the circulation arrangement for securing uniform air distribution. The "false roof" of a Super-Coach contains thousands of small holes through which the cool, fresh air enters the bus. The air is completely changed in volume every three minutes. The cool air sinks and when it reaches the floor, it is removed through special vents.*

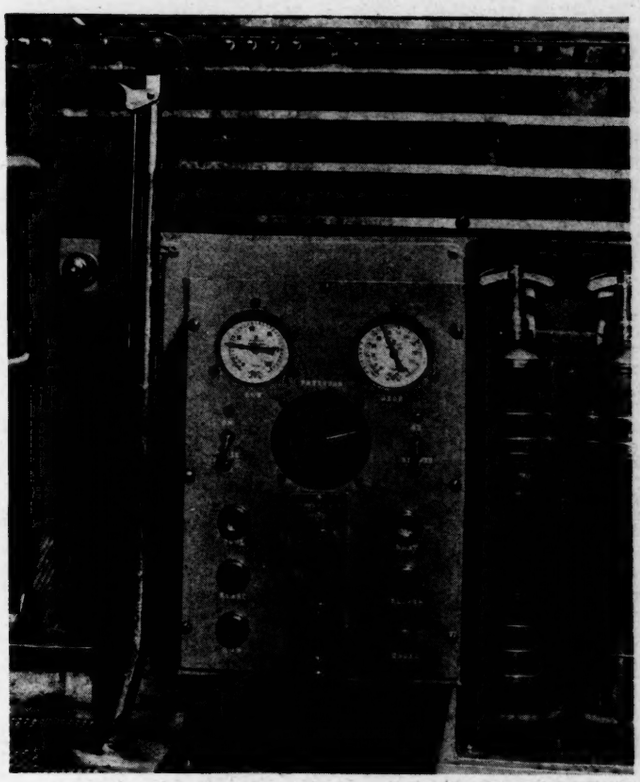
Compact cooling units are mounted in the ceiling space in the rear of the bus, where fresh air is brought from grilles in the front of the bus. Air is forced into the space above the false ceiling by centrifugal fans with power from the lighting batteries. Returning air reaches the cooling unit through grilles in the ceiling at rear of the bus.

3 *(Right) But the driver is in charge, for the master control station gives him constant supervision and control of the conditioning. Both visible and audible signals are provided, together with temperature regulator and auxiliary choke for starting the unit.*

When the master switch is closed, a safety light indicates that fans are operating to circulate air. This indicator reduces the possibility of the driver leaving fans running when the bus is taken out of service, which would result in draining of the batteries.

In summer service, the unit master switch is closed and, when the temperature in the bus rises, to the point requiring cooling, the engine with automatic choke feature starts the unit. During the engine cranking cycle a red visible safety light shows on driver's control panel. When the engine has started and attained proper speed, this visible signal changes to green which indicates running position. A cranking limit switch prevents cranking of the engine for an extended period should it fail to start. When this condition occurs, a visible signal so indicates. The driver has an auxiliary choke to assist in case of sluggish starting of the engine. The control panel also carries a temperature regulator.

Unusual features include an automatic load control to increase the capacity of the refrigerating unit under increasing heat loads and a special selector control to insure proper sequence of all functions during starting and stopping of the automatic unit.



In addition to the technical requirements, it is necessary that bus equipment be light in weight, compact, noiseless in operation, and exceptionally efficient in order to handle the heavy cooling load. Sun radiation is an important factor. Bus company officials were anxious not to disturb the graceful streamlining of their modern buses by unsightly, wind-resisting compartments on top of the coach, and no interference with normal operating facilities could be permitted.

The Interstate Transit Lines took up the task of solving these problems some two years ago. Soon experimental buses were on the road, and test buses were operated in regular service all last summer between Omaha and Los Angeles via Salt Lake City. Much of this territory is subject to excessive heat during the midsummer. This is especially true of the Mojave Desert between Las Vegas, Nev. (gateway to Boulder Dam), and Los Angeles.

In its final form, the Interstate system consists of four principal units—the air conditioning refrigeration power unit, the condenser, the cooling unit, and the master control station. The accompanying photos show the outstanding features and permit gathering a good idea of how the air conditioning equipment is fitted into the buses.

One of the most interesting features of this important new phase of air conditioning is the fact that it was developed and perfected entirely in Nebraska, which most people think of as being strictly an agricultural section. The headquarters of both the bus company and Baker Ice Machine are in Omaha.

The Downward Trend of Size and Weight of Refrigerating Machinery

By ARNOLD H. GOELZ†

CONTINUAL research and engineering development of refrigerating units for air conditioning has reduced both weight and space required per ton to about one-sixth of that thirty years ago when comfort cooling was just beginning. Compared to present-day hermetically-sealed condensing units the accompanying graphs illustrate sharp drop in square feet of floor area and pounds per ton.

It is interesting that although the relationships varied widely over the years they now stand at nearly the same percentage.

For the air conditioning industry to have reached its present high degree of development many factors have contributed, including new refrigerants for increased safety and efficiency; mechanical advancements, such as reduced noise vibration and lower maintenance; and electrical achievements, decreasing first cost and operating expense.

In order to know where we stand today, it is necessary that we know what has previously taken place. Practically all of the earliest refrigeration machines used ammonia as the refrigerant, and machines of this type came into use over fifty years ago. About forty years ago, refrigeration machines using carbon dioxide as a refrigerant were introduced.

The application of mechanical refrigeration for cooling of air for human comforts was started about thirty years ago. As it was most practical to use direct expansion coils for cooling the air, it was necessary that the refrigeration system employ a safe gas and, for this reason, the carbon dioxide refrigeration machine was, until a few years ago, most generally used for air cooling.

The best valve design and materials thirty years ago necessitated that compressors be operated at very low speeds, a 37-ton machine running at approximately 70 r.p.m. and a 111-ton machine at approximately 65 r.p.m. This resulted in very large and bulky machines. As pressures of 1000 to 1200 lb. are required for the liquefaction of carbon dioxide, it was necessary to resort to very heavy construction. Due to low speeds, the compressor was provided with a large heavy fly wheel and the motor was of slow speed, about 600 r.p.m. This required a wide heavy double leather belt which meant large belt centers and spreading of equipment over a large floor area. At that time, double pipe condensers were commonly used. As welding was not yet in use, heavy semi-steel fittings were required for the condensers and other parts of equipment, resulting in the great bulk and weight.

Ten years later engineers were striving for a machine which could be operated at higher speeds to reduce dimensions and weights. The development of the plate type valve permitted compressors to be operated at about twice their former speed, reducing dimensions and weight. The higher speed of the compressors made it possible to use higher speed motors, but cumbersome leather belts were still a necessity. While changes and improvements permitted more compact condenser design, the condensers still required considerable space.

About ten years ago, the vertical compressor had been developed for carbon dioxide, allowing the compressors to be operated at an increase in speed. These compressors operated at speeds of approximately 300 to 400 r.p.m., making practical the use of directly connected motors and the elimination of objectionable belts. Application of welding made practical the use of shell and tube type condensers which brought about a saving in weight and in space requirements.

All of the early refrigeration equipment required heavy foundations, generally built of concrete, limiting the installation of this equipment to ground floor or basement.

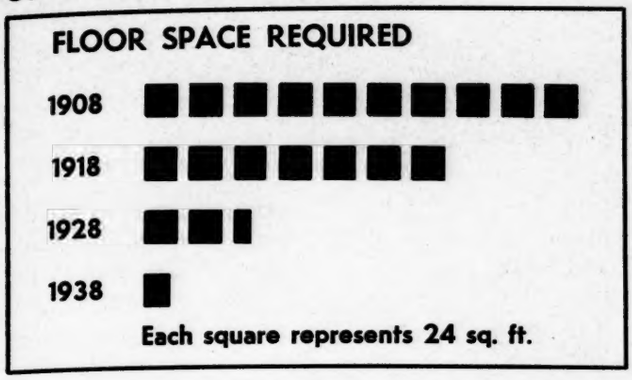
Only the high spots in the development of refrigeration machinery have been mentioned but there were many other improvements such as changes brought about by the application of welding, modern lubrication, etc. These improvements gradually reduced the amount of attention required by the machinery and effected a saving in maintenance costs. The carbonic machine, principally used for air cooling, did not, on account of the high pressure, lend itself to automatic control. All air conditioning installations were almost entirely under manual control. As the carbonic refrigeration machine was improved in design, there was a reduction in noise and vibration, but what was considered a quiet machine in years that have gone by, would not be considered so today.

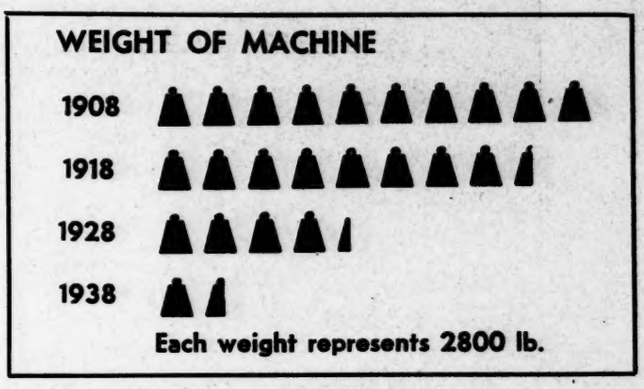
Prior to 1928 refrigerants other than carbon dioxide were used for air conditioning work, but they were suitable for only the very large units, and this discussion is limited to the smaller refrigeration equipment using the reciprocating compressor. About eight years ago F12 was introduced as a refrigerant. This is a safe refrigerant, suitable for direct expansion air cooling systems, and has the advantage of liquefying at low pressures. It has, therefore, opened the door for very marked and rapid development of refrigeration equipment, especially for air conditioning. The low pressures required readily enable the use of automatic equipment.

Today, machines are high speed to achieve compactness. Modern feather valve design, careful balancing of parts, and forced feed lubrication permit condensing units to operate at high speeds with practically no vibration or noise. The speeds at which such units operate allow the use of direct connected motors, eliminating belts which are always a source of uncertainty and an-

†President, Kroeschell Engineering Co., Chicago, Ill.

TREND OF REFRIGERATING MACHINE SIZE
37 TONS CAPACITY





noyance. By building the compressor and motor into one piece of machinery, and eliminating the seal, engineers have made another achievement. Not only is compactness and elimination of the coupling a great stride forward, but the elimination of the seal is of vital importance for, no matter how well a seal is designed, it is not perfect, and at some time will require attention or replacement. The elimination of the seal makes the condensing unit absolutely gas tight, preventing the loss of refrigerant. Mounting the motor driven compressor directly on the condenser, without the use of a sub-base, is a most practical and satisfactory arrangement. In striving for compactness, accessibility has not been overlooked, as all parts are accessible.

Lack of sufficient and inexpensive water supply has, in many cases in the past, prevented the installation of air conditioning equipment. The modern evaporative condenser, well designed and efficient, makes possible the installation of air conditioning systems where there is a shortage of water or where water is expensive.

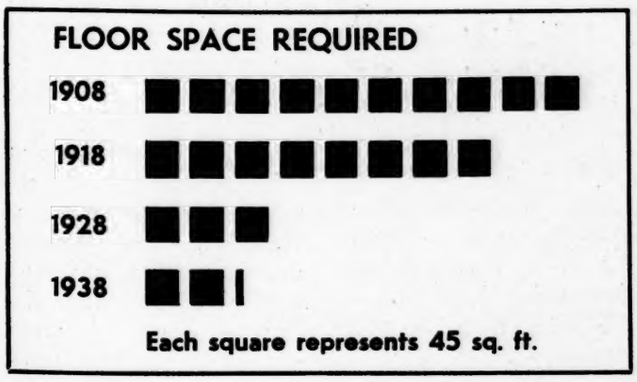
For many years there was little development in what was formerly known as the low side of cooling coils, or what is today generally called evaporators. For a long time coils were made of extra heavy pipe electrically welded into continuous lengths. About twelve years ago the industry started using finned coils. Manufacturers of carbon dioxide equipment started using finned cooling coils for air conditioning equipment about ten years ago. The use of fins reduced the amount of pipe or tubing, reducing bulk and weight of coils. Freon as a refrigerant permitted the use of lighter weight tubing, and there has been a rapid development in evaporators during the past ten years. These factory-made units are produced at a cost much lower than that of units assembled on the job.

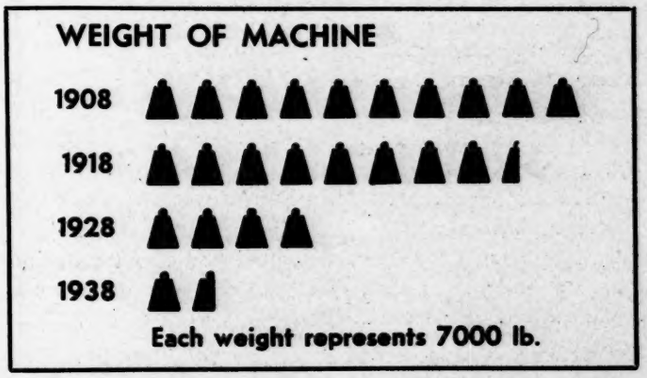
Paralleling the progress in refrigeration machinery and evaporators, there has been a marked development in expansion valves, control equipment and other accessories.

Improvements in design and methods of manufacture have reduced the cost of the refrigeration equipment. The actual cost in dollars is, today, less than in previous years. This is true in spite of the fact that wages paid to mechanics manufacturing the equipment are, today, approximately three times what they were thirty years ago. Condensing units are now sold at so low a price that as many as three or four small units can be installed in competition with a single large unit. The advantage of several units, especially for automatic control, is well known. Today not only is the cost of equipment lower, but the cost of installation of this simple, compact, light weight, dependable refrigeration equipment is tremendously less than the cost of installation of equipment of former years.

I am a sincere optimist and believe that refrigeration equipment, like other machinery and equipment, will in time be further improved, for progress can never be stopped. Air conditioning units today are as well developed and perfected as is the most modern automobile, airplane or radio. It is modern, dependable refrigeration equipment, available at a low price, that is increasingly expanding the use of air conditioning.

TREND OF REFRIGERATING MACHINE SIZE
111 TONS CAPACITY





Ultraviolet rays being used for keeping the wound sterile during an operation. Photo courtesy Westinghouse.

Present Position of the Medical Aspects of Air Conditioning

By C. P. YAGLOU

FROM the standpoint of comfort and health the problem of winter air conditioning appears to be mainly one of rational heating supplemented with adequate building insulation and with sufficient ventilation, by natural or mechanical means, to remove objectionable body or tobacco-smoke odors.

Air and Wall Temperatures

Air temperature and particularly sharp temperature changes are as a rule the most important factors. While a moderate variability of temperature toward the cooler side of the comfort zone is stimulating and probably beneficial, there is much good evidence to show that great temperature changes may have a deleterious influence by increasing susceptibility to upper respiratory diseases. A most difficult problem in winter air conditioning is how to reduce the sudden temperature changes experienced in passing from a warm room to cold outdoor air. Obviously, this is difficult to accomplish with conventional methods and equipment. Some persons believe that the solution of the problem might be found in radiant methods of heating, but so far nothing practical has been achieved.

Next to air temperature, the temperature of the exposed walls and glass is of considerable importance. A room heated by the usual convectional methods may be uncomfortably cool at 75F or even at 80F in cold weather if the insulation of the walls is poor. Owing to a steep temperature gradient between floor and ceiling, the feet are cold and the head too warm, a condition that is inimical to comfort and health.

Years of experience in England have shown that a combination of warm walls and relatively cool air is distinctly more comfortable and pleasant than one of cold walls and warm air; such an arrangement also reduces, to some extent, the temperature contrasts between outdoors and indoors. Radiant panel heating methods have distinct advantages in these respects, but their applica-

Much has been done to learn the individual effects of the various functions of both winter and summer air conditioning and to evaluate their desirability from the standpoint of comfort and health. So also is air conditioning being increasingly used as a means of treating certain diseases. At the meeting of the Public Health Engineering Section of the American Public Health Association in October, 1937, Prof. C. P. Yaglou of the Harvard School of Public Health reviewed the latest information available. His statement, from which the accompanying material is abstracted, can be taken as a calm, dispassionate exposition of what is currently known.

bility to cold climates involves a number of economic and engineering difficulties that have yet to be overcome. Work now in progress at the John B. Pierce Laboratory of Hygiene, under the direction of Doctor Winslow, may shed considerable light on disputed points.

Suitable wall insulation, in conjunction with convectional heating methods, will materially improve the comfort of a room by reducing infiltration and by keeping the inside surface temperature of the exposed walls close to the air temperature. Such a room would be comfortable at temperatures between 70F and 73F instead of 75F and 80F, in poorly constructed buildings.

Humidity

This factor, although very important in warm weather, is of little consequence in cold weather except in special instances. The usual variations of humidity during the heating season have been found to produce little effect on comfort, and from the standpoint of health the evidence is overwhelmingly on the negative side. Subjectively a low humidity is generally preferred to a high one, especially when the latter is obtained by mechanical methods.

Exceptions have been found in persons suffering from frontal sinusitis and other infections of the upper respiratory tract characterized by excessive dryness of the nose. The same subjects, however, disliked the humid air after their condition improved. A low humidity also seems more agreeable than a high one in catarrhal conditions of the nose but the data are too meager to allow a definite conclusion. In the light of these suggestive data, a study of the effects of dry and humid atmospheres on upper respiratory disorders may offer a fruitful field for research.

In properly heated buildings, the natural relative humidity seldom falls below 20% owing to a stabilizing influence of hygroscopic materials in the walls and furniture. Artificial humidification may lead to serious trouble from condensation and freezing of the moisture inside certain building materials composing the outside walls.

Air Movement and Drafts

Within the usual limits, air movement is not a factor of great importance. The aim in ordinary ventilation work is to keep the movement of air at or slightly above the threshold of perceptibility so as to impart a sense of freshness without drafts. Usual practical values are between 15 and 50 f.p.m. during the heating season.

The problem of drafts is difficult to solve to the satisfaction of all because the trouble does not always arise from faulty air conditions but often from an inherent instability of the heat-regulating system of the body, particularly from poor blood circulation to the extremities and deficient vasomotor response in certain individuals. The draft-susceptibles may suffer considerably on exposure to ordinary air conditions that are perfectly satisfactory to the majority of normal persons. Even a temperature of 72F with an air movement of 20 f.p.m. may prove objectionable to some persons who like heat and cannot stand the cold, because of their low metabolic rate. Such individual idiosyncracies may be counteracted by the use of suitable clothing that will keep the extremities warm. Few persons, however, would be willing to depart from custom and fashion unless their health is seriously threatened.

Mechanical Ventilating and Air Cleaning

These two factors are very important in theaters, auditoriums, industrial plants, and like locations, where large volumes of air must be constantly supplied, but in the average home and uncrowded office natural ventilation is sufficient for every practical need, except in the kitchen and bathroom where separate means of ventilation are desirable in order to prevent diffusion of odors to other sections of the building.

According to prevailing belief, the minimum fresh air supply in general ventilation work is that needed to dilute and remove unpleasant body or other odors that have hygienic significance. Under ordinary conditions, a fresh air supply of about 15 c.f.m. per person appears to be quite satisfactory in public buildings when each occupant is allowed an air space of about 200 c.f.m. This quantity is usually sufficient to satisfy the thermal requirements, except in warm weather when the air is not cooled artificially. In all instances, the total air supply, including outside air and recirculated air, must be sufficient to maintain comfortable thermal conditions and to prevent the accumulation of objectionable odors.

In industries where the primary object may be the control of toxic dusts, fumes, or gases, the air supply must be sufficient to dilute the polluting elements to a concentration below the physiological threshold.

So far as ordinary atmospheric dust is concerned, the objection is believed to be not so much a matter of health as of nuisance and esthetics.

Health and Economic Aspect of Winter Air Conditioning

In the past few years, several studies have been carried out to determine whether winter air conditioning affects favorably the health and efficiency of office workers. The best controlled studies are those of McConnell, including a total of 10,000 employes, half working in conditioned offices and the other half in offices not equipped with air conditioning equipment but otherwise properly heated and ventilated. Records of illness, absenteeism, and other pertinent factors showed no significant difference between the two.

Reports from commercial sources are contradictory. Claims are often made of definite benefits to health and efficiency, but the data are too meager and without controls. Such data are probably of little value owing to the well-known variability in the incidence of upper respiratory diseases from year to year and month to month.

We must admit, at the outset, that the evaluation of any specific influence on health is extremely difficult, because of lack of suitable standards and the simultaneous operation of many extraneous factors outside the place of work, some of which have probably a much more powerful influence than the air conditions at work. All we can say at present is that no authentic evidence exists to prove any superiority of winter air conditioning over rational heating.

Summer Air Conditioning

Cooling in warm weather may contribute much to the comfort or discomfort of man depending upon the method and extent of cooling. Much has yet to be learned about this important branch of air conditioning. Above all, temperature contrasts must not be too great. An indoor temperature even 10 to 15F below the outside temperature, as is now the practice in warm weather, appears to be objectionable and harmful to some persons. We often hear of head colds originating in overcooled theaters, restaurants, or railroad cars on warm summer days. Headaches, stomach upsets, and a general feeling of fatigue are other conditions attributed to overcooling. Although many healthy individuals seem to be perfectly capable of adjusting themselves to such temperature changes without discomfort or after-effects, little is known about possible damage to health that may result from too frequent exposure.

Adaptation to summer heat renders the organism sensitive to cold and temperature changes especially when the body surfaces are wet with perspiration. The tone of the heat-producing organs is depressed and the metabolic rate may fail to increase sufficiently, or quickly enough, on exposure to sudden chilling. The "cold shock" experienced on entering a cooled space on a warm day is found to be due to an excessive increase in the heat loss by evaporation of perspiration without an immediate compensatory increase in the metabolic rate. Conversely, the feeling of depression and discomfort experienced in passing from a cooled space to warm outdoor air appears to be due to a lag in sweat-gland activity and the consequent retention of body heat.

The solution of the problem would seem to lie in dehydrating the air to a comparatively low humidity, without reducing the temperature more than a few degrees below the prevailing outdoor temperature. In this way, temperature contrasts are moderated upon entering and leaving the conditioned space and, according to current research, there are no untoward symptoms in the transitional period of readjustment.

Health and Economic Aspects

The benefits of summer cooling in commercial and industrial fields are now generally appreciated. There is much good evidence to show that cooling under adverse conditions of heavy physical work and heat should prove beneficial to both employer and employe by increasing the output, decreasing illness and accidents, and lessening fatigue. In office work, however, where the physical activity is light, McConnell was unable to detect any significant improvement in the health or efficiency of approximately 6000 employes of the Metropolitan Life Insurance Company in the course of a summer season, despite the conspicuous improvement in comfort. The employes were able to pursue their work without the depression and discomfort experienced prior to the installation of cooling apparatus.

For the average home and small office, cooling may be a potential necessity, but for the time being, it is still too expensive for general use.

Therapeutic Aspects of Air Conditioning

Aside from comfort and health, air conditioning is proving to be a valuable adjunct in the treatment of disease. In operating rooms conditioned air is gradually becoming indispensable in reducing the risk of explosion of anesthetic gases and safeguarding the patient, surgeon, and operating team against excessive summer heat.

In premature nurseries of institutions, the maintenance of a suitable temperature, according to individual requirements, with a relative humidity of about 65%, as determined by extensive research, results in a great reduction in the incidence of respiratory and gastro-intestinal diseases, and improvement in the infants' chances for life.

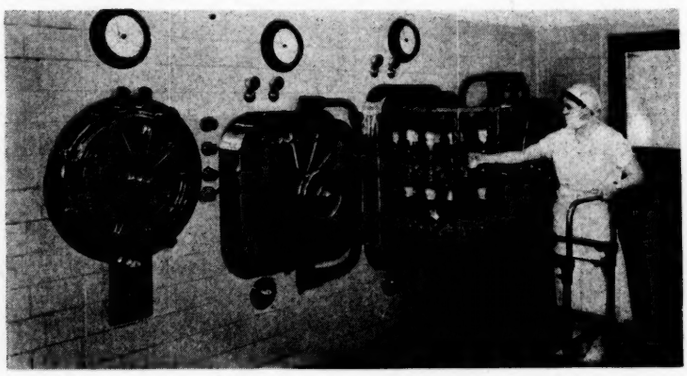
In the artificial production of therapeutic fever, conditioned air is proving to be the preferred method of treatment.

In oxygen therapy, air conditioning is concerned with the conservation of oxygen, and the removal of excess carbon dioxide, heat, and moisture.

Hay fevers and pollen asthma offer a wide field for application of air conditioning in the home, office, or clinic, the main objective being adequate filtration of air. Unlike specific desensitization, treatment by conditioned air is not curative but gives only temporary relief. With rare exceptions, the symptoms recur on exposure to pollen-laden air.

Cooling in warm weather is of great assistance in the treatment of pyrexias in the new-born, in enteric disorders, fevers, heat stroke, heart failure, and a variety of other ailments that often accompany summer heat waves. Considerable research is now in progress on a wide variety of diseases in which air conditioning may prove of value.

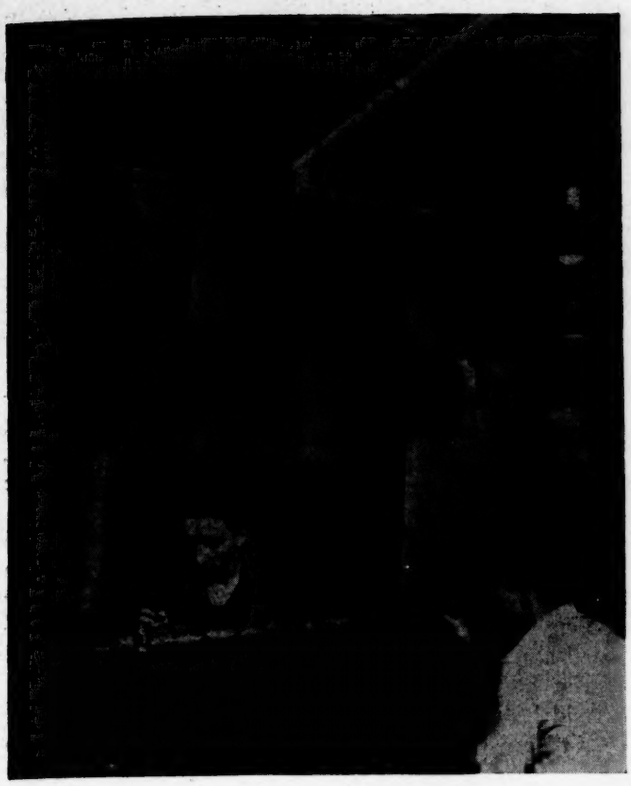
Of particular significance to operating rooms and contagious wards is the recent use of ultraviolet light for sterilizing air.



Desirability of Adsorption Dehumidifiers in Air Conditioning

By BAYARD P. FONDA†

Taking moisture out of air without reducing the air temperature to the dewpoint is attracting more and more attention as time goes on. The present field for this method is largely confined to those situations where the moisture load is great relative to the total heat to be removed. The list of some of the places where adsorptive dehumidification has been used may be surprising because of the range already covered.



Roller engraving processes require exact control of humidity. In this plant a constant humidity is maintained by the dehumidifier shown in the background.

UNFORTUNATELY, at the start the air conditioning industry got off on the wrong foot on account of the great confusion that existed, and which has now only been partially corrected, regarding the meaning of the term "Air Conditioning." Many disappointments resulted through the purchase of equipment without an understanding of just what results might be expected. It is only through the advertising of the bona fide manufacturers that the public is slowly learning that true air conditioning means the heating, cooling, humidifying, dehumidifying, circulating, and cleansing of the air. Ventilation, or fresh air introduction, is regarded as part of air circulation.

There is a great temptation to advertise as air conditioning equipment, devices that cannot control the six elements of air conditioning as enumerated above. This temptation exists because of the great spread in costs between equipment which controls only some of these functions and equipment which controls all of them. Furthermore, equipment which is adequate for one part of the country is certainly inadequate for weather conditions prevailing in other parts of the country.

Several of these six functions of year-round air conditioning can be produced with relative ease and economy. The circulation of air can be accomplished at low first cost and low operating cost. Numerous inexpensive filters are on the market which do an excellent job of air cleaning. Heating has been developed to a high degree, and innumerable makes of unit heaters and central heating plants using every conceivable fuel at good efficiencies, are available. Automatic domestic heating plants are almost a necessity in this day and age. With the modern forced warm air heating system the problem of humidification is simple.

But now we come to the more difficult summer functions of dehumidifying and cooling. These two functions are inextricably related for human comfort. In most of the thickly populated sections it is not possible to produce summer comfort by simply cooling the air. The air is not only too warm, but it is too wet, and dehumidifying is essential to produce a comfortable condition. It is on this phase of summer air conditioning that adsorption dehumidifiers are so valuable.

There are several possible methods of effecting these dehumidifying and cooling functions. The air may be chilled in passage through a cold water spray or over finned tubing containing a refrigerant. In this manner it may be cooled below its entering dewpoint, and this must be the case if any dehumidifying is to take place. The heat removal may be accomplished through the use of refrigerant compressors, which may be driven by steam, electricity, or gas engines. The steam ejector thermo compressor using water as a refrigerant may also be utilized.

In many instances where air is dehumidified by chilling, there exists a certain disadvantage, viz., the moisture cannot be removed without radical reductions in the temperature of the air so treated. In certain climates and under certain conditions this drop in the temperature of the air may be not only allowable but quite desirable. On the other hand, and excepting the practice of reheating which is thermodynamically uneconomical, the radical lowering of the temperature of the air is the greatest stumbling block to the refrigeration method of air conditioning. Under variable ratios of sensible heat load and moisture load the temperature is too inclined to creep downward, and the humidity is apt to creep up. The result is the loss of control of the job and the lack of the intended comfort condi-

†The Bryant Heater Co., Cleveland.

tions. This is especially true when comfort air conditioning is most needed; that is, when the dry bulb temperatures are not extreme but the humidity is uncomfortably high.

Because of one of the psychrometric principles—the adiabatic saturation of air—another method of securing a comfortable atmosphere is presented. When unsaturated air is exposed to a free surface of moisture, an adiabatic heat exchange takes place, and some of the heat of the air is used to evaporate water, resulting in a decrease in the temperature of the mixture and an increase in its humidity. By properly controlling the quantity and the dryness of treated air, a comfortable atmosphere may be secured no matter what proportion of moisture load and sensible heat load may exist. However, a word of caution on this subject is in order. Whether or not this plan is feasible on a particular problem depends largely on the character of the air conditioning load and the relative costs of power, cooling water, and like items. No blanket statement should be made, but the possibilities are definitely there.

The present compressor types of small unit air conditioners have the advantage that they are compact. Some of them are air cooled, requiring none but power connections, and they may be marketed and installed as a single package unit. One of their greatest disadvantages is the resulting interdependency of dry bulb temperature reduction and moisture removal and the lack of control over these functions.

No such disadvantage exists if separate pieces of equipment are provided to handle the sensible heat load and to handle the moisture load. In this system, a dry air machine is used to dehumidify the air to the proper point without affecting the temperature in the slightest. Similarly, cooling coils are utilized only for temperature reduction, no dehumidifying being necessary by the coils. Such a system is capable of following the wide variations in the ratio of heat and moisture loads which occur from day to day and still the proper condition for comfort is exactly maintained.

A machine for producing dry air has the further advantage that the dry air may be used for a great variety of industrial applications, as well as for comfort applications. Through the use of a solid adsorbent dehumidifier, moisture may be adsorbed directly from the air, and the latent heat of condensation, plus the heat of wetting, appears in the effluent dried air at increased temperature head. This heat may be readily removed by available cooling water or by water from a cooling tower, and the dried air may be used as is, or it may be partially resaturated to give some cooling effect.

There are three distinct summer climates or types of prevailing summer weather conditions in this country which make comfort air conditioning desirable. First, there is the condition of high dry bulb temperature and low humidity. Secondly, there is prevailing high dry bulb temperature and high relative humidity, and, lastly, there is moderate dry bulb temperature with high relative humidity.

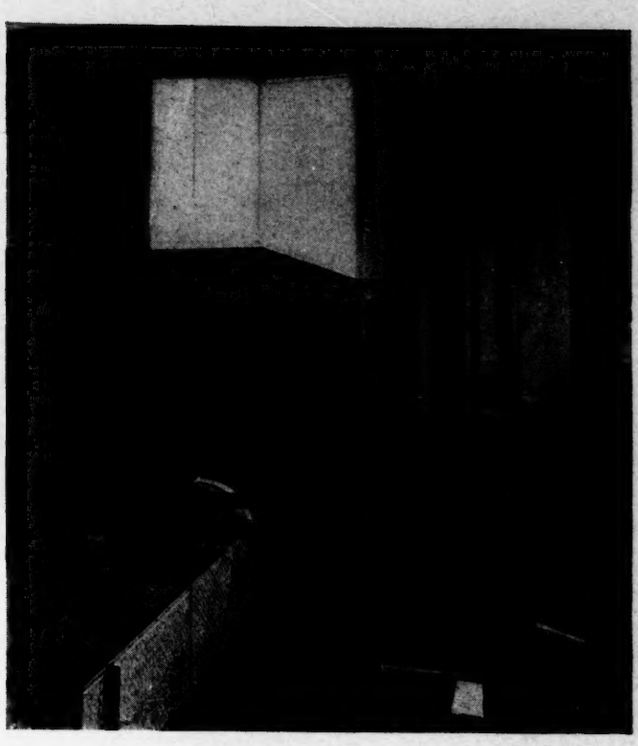
The first of these conditions is the easiest in which to provide summer comfort. Adiabatic air saturation is allowable because the air is dry and the adiabatic cooling will not result in excessive humidity. Some small amount of additional dehumidifying may be necessary at times on account of this resaturation. It should be understood that "saturation" and "moisture in air" are terms that are being used very loosely in this discussion. Actually, the air and the water vapor existing in a given space are each obeying its own laws independently. However, the mechanical mixture of the two must always be considered in any heat transfer problem.

The second climatic condition of high dry bulb temperature and high humidity requires both cooling and dehumidifying, and this may be effected through the use of separate pieces of equipment for the cooling and for the moisture removal, or it may well be done by simultaneously cooling and dehumidifying the air, as with refrigeration for example.

The third condition of moderate dry bulb temperature and high humidity presents a tough problem for refrigeration air conditioning, as it will be remembered that with this system dehumidifying cannot be accomplished without cooling. Since in many cases little or no cooling is needed, over-cooling must result with refrigeration, unless reheat is used. On the other hand, under such conditions the dry air machine is ideal. The cooling, being done by an entirely separate piece of equipment, may be controlled exactly from no load to full load and the flexibility of control of such a system is obvious.

In every case where a dry air machine is used, and where more or less cooling is also required, it is best to use the available water supply to do this cooling if the water is sufficiently low in temperature. Well water is usually ideal for this purpose. Its temperature is usually low enough to do an excellent cooling job but it is rarely low enough to do

A low humidity room for refrigerated showcase glazing. A dehumidifier maintains a low dewpoint to prevent future fogging of the glass in the showcases.



(Above) Interior view of a lacquering room. A dehumidifier supplies dry air to permit proper drying in the summer time. (Right) A silica gel dehumidifier installed on a comfort air conditioning system with well water cooling. The dry air cooler is seen in the top foreground.

sufficient dehumidifying for adequate humidity control.

In comfort air conditioning it would appear that the production of dry air is a sound solution to the problem of widely varying climatic conditions and widely varying internal heat and moisture loads.

The residential air conditioning field presents a slightly different problem from that of commercial or theater air conditioning. In this field, adsorption dehumidifiers coupled with night air for cooling represent a feasible plan. In many residences, with the assistance of night air cooling, if the doors and windows are kept tightly closed during the day, the temperature rarely rises to an uncomfortable point, but dehumidifying is most certainly necessary to maintain a comfortable condition. It must be remembered that heat insulation of houses is cheaper than summer air conditioning at present, but the need for dehumidifying is a vital one in the residences of dozens of our largest cities.

Dehumidification for Industrial Processes

To appreciate why adsorption dehumidifiers are valuable in industry, we must understand how the drying of materials is accomplished.

In every drying process, water must be extracted from the body or from the surface of the material being dried, and this water usually leaves the surface as a vapor. The drying is a process of evaporation. If the material is surrounded by an atmosphere of 100% relative humidity or a saturated atmosphere, obviously no drying can be done. But, if the atmosphere is not saturated, more or less drying will occur.

The speed, and to some extent the amount of drying, depends primarily upon two factors: the air motion around the material and the "evaporative head" or relative humidity of this air. The greater the air motion and the lower the relative humidity, the more rapid and the more complete will be the drying.

To provide the air motion and surface exposure for drying is relatively simple, but the lowering of the humidity presents a greater problem. The relative humidity may be lowered in two ways: first by increasing the temperature of the air as by the direct application of heat, and secondly by extracting moisture from the air.

As air is heated its capacity for moisture is increased and its relative humidity is lowered. But in many cases the temperature cannot be raised because the material would be ruined or because people are subjected to this air. In such cases, low relative humidity and high "evaporative head" can be produced by the direct extraction of moisture with a dehumidifier.

The use of this cool dry air permits many manufacturing processes to continue in humid weather, where otherwise there would be a serious retardation or even cessation in production. Of course, in many cases it is not necessary to actually dry the product, but it must be kept in a dry atmosphere during manufacture or packing. Here again, dehumidifiers can provide the necessary dryness without affecting the temperature of the rooms.

In the industrial field adsorption dehumidifiers have already been found especially valuable in the following processes:

Drug and pharmaceutical manufacturing,
Lacquering rooms,
Refrigeration showcase glazing,
Electrical manufacturing,
Shoe and leather drying,
Dental porcelain manufacturing,
Pencil manufacturing,
Plastics manufacturing,
Rayon testing laboratories,
Lithographing and printing,
Storage of rugs and antiques,
Photo reproduction processing,
Film drying,
Biological laboratories,
Safety glass manufacturing,
Tobacco drying and testing,
Cork processing.

And so we see that the adsorption type dehumidifier has a very definite place in both comfort and industrial air conditioning. The future years will see more and more of this type of air conditioning equipment installed.

Talks on Stoker Coals Feature of Conference

OVER two hundred and fifty coal dealers, stoker dealers and stoker manufacturers attended the Third Conference on Solid Fuels and Domestic Stokers sponsored by the University of Wisconsin and held at Madison April 20-22. The Conference preceded and the final day's program overlapped the Conference on School Building Heating and Maintenance also sponsored by the University April 22-23.

The stoker conference was held in the Auditorium of the Mechanical Engineering Building, while in the laboratory a number of manufacturers exhibited attractive displays of products pertinent to the coal and stoker trades. Included among these manufacturers were Minneapolis-Honeywell, Anchor Stove & Range, Whiting, Butler, Perfex, Mercoid, Iron Fireman, McDonnel and Miller, Bell & Gossett, Detroit Lubricator, Winkler Mfg. Corp., Conco-Sampsel, and Motorstokor.

The first session was opened by Prof. Ben G. Elliott, chairman of the Conference, who introduced Acting Dean A. V. Millar of the College of Engineering, who briefly welcomed the Conference to the University.

Lane W. Hildreth, secretary of Anthracite Institute, spoke on "Anthracite as a Domestic Fuel," and referred to the fact that anthracite is again being shipped in sizable amounts to the middle west. He discussed the sizes of anthracite which should be burned in different size heating equipment, outlined the advantages of anthracite and instructed the audience as to how anthracite should be burned. He described the various types of equipment available for burning anthracite and mentioned that a home was recently built with coal and ash vaults sufficient to take care of the year-round supply of coal and capable of storing ashes from a year's operation.

At the evening session the Anthracite Industries' motion picture, "Green Lights Ahead," was shown, preceded by a talk, "Smoke Has No Defense," by W. E. E. Koepler, secretary, Pocahontas Producers Association. I. M. Remen of the Holland Furnace Co., Chicago, gave one of the best talks of the Conference on "Selling Stokers on the First Call."

Herman Winkler, chief engineer of the Winkler Mfg. Corp., who spoke on the domestic stoker, confined his address principally to engineering problems connected with stoker design and operation. Mr. Winkler explained each of the important parts composing a stoker, their functions, and the factors affecting their design. He said that the coal which should be used in a soft-coal burning stoker should be between 3/8 in. and 1 in. in size and of a good grade. He stressed the fact that a stoker should not be considered as a catch-all for all odds and ends from the coalyard if good operation is expected.

R. M. Gehl, assistant sales manager, Gehl Bros. Mfg. Co., spoke on "Selling Domestic Stokers," followed by A. B. Meeg, branch manager, Iron Fireman of Milwaukee, who described his company's experience in finding and training stoker salesmen. Good stoker salesmen, Mr. Meeg said, must be willing to do a full day's work, be able to get along with people, be capable of managing their own financial affairs, have the ability to make friends with customers, be qualified to plan their own work, and eventually build up their own clientele. His company has found out, he said, that the best sources of information on prospective stoker salesmen are stoker owners, colleges, ministers and priests, chain store managers, secretaries of lodges and clubs and personal applicants.

The highlight of the Conference was the annual dinner held in the Memorial Union Building at which John J. O'Conner of the Wisconsin Ice and Coal Company presided. Grant Haas, Madison newspaper columnist, spoke on "Europe at the Moment," following which was the second annual presentation of the Wisconsin Bull Hide which this year was given to Elmer H. Kelling, Center Street Fuel Co., Milwaukee, for meritorious service.

A panel discussion on stoker coals and domestic stokers under the chairmanship of K. C. Richmond, editor of "Coal-Heat," was held in the afternoon at which the following discussions were presented: "Some Experiences with Stoker Coals," E. D. Benton; "As a Coal Dealer Looks at the Problem," Elmer H. Kelling; "How to Sell More Stokers," W. E. Daugherty; "A Stoker Dealer Looks at Stoker Coal," Frank Kollock; "Some Experiences of a User of a Domestic Stoker," George J. Barker; "Stoker Coals from the Dock Man's Point of View," G. M. McDonald; "What I Have Observed About Domestic Stokers and Stoker Coals," Royal Holbrook.

In the evening Prof. G. L. Larson spoke on "What Becomes of the Heat We Buy," followed by a presentation of the Johns-Manville talking picture "Heat and Its Control."

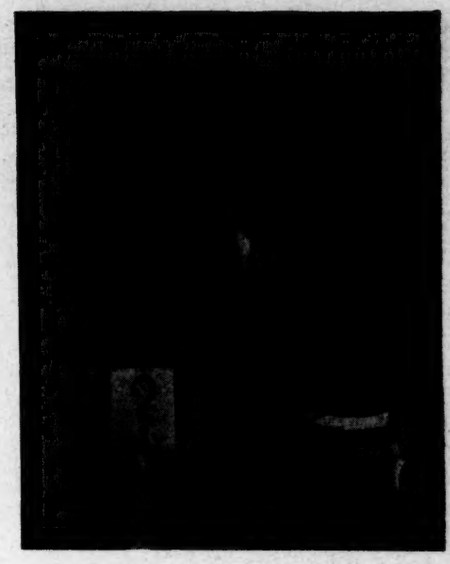
Among the other papers presented at the Conference were "The Significance of Degree-Days in Domestic Heating," by Prof. D. W. Nelson; "Advertising in the Fuel and Stoker Business," by C. Franklin Brown, Chicago.

"Recent Developments in Prefabricated House Construction at the U. S. Forest Products Laboratory" were described by R. F. Luxford, featuring the wood prefabricated house developed by the Laboratory.

A full session was devoted to the selection, purchase and use of fuels and fuel burning equipment for schools, institutions, and other public and semi-public buildings. Papers were presented as follows: "A Fuel Management Program for Schools," by A. C. Smith; "Practical Methods of Coal Selection and Purchase," by John C. White; "The Stoker in School Heating Plants," by Frank Hoke; "Some Experiences with School and Institutional Heating and Ventilating Plants in the State of Iowa," by Royal Holbrook.

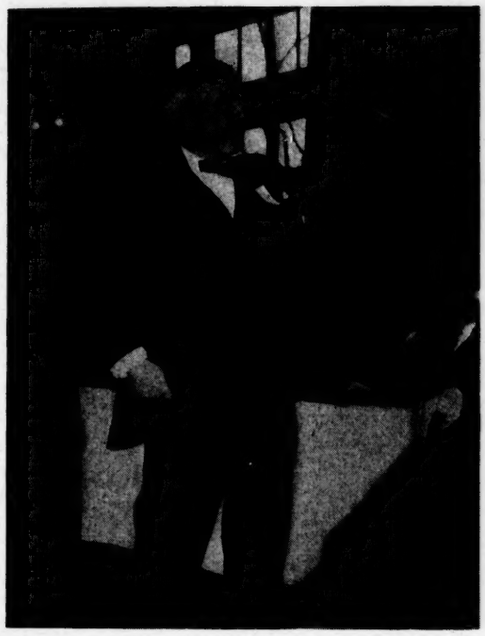
In the evening a demonstration and clinic on the firing and care of heating plant boilers was given in the boiler laboratory of the mechanical engineering building under the direction of Carl F. Olsen, superintendent of service, Kewanee Boiler Co., who also spoke on the "Management and Care of Heating Plant Furnaces and Boilers."

Prominent at the Conference were (left to right) Prof. Ben G. Elliott, chairman, a member of the University of Wisconsin faculty; I. M. Remen, Holland Furnace Co., Chicago; Lane W. Hildreth, secretary, Anthracite Institute, New York: John J. O'Conner, Wisconsin Ice and Coal Co., Milwaukee, and Grant Haas.



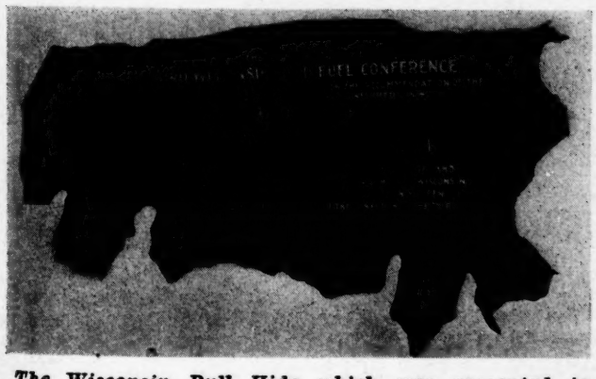
Herman Winkler, chief engineer of the Winkler Manufacturing Corp., Lebanon, Ind., addressed the Conference on the modern domestic stoker.

Third Annual Wisconsin Stoker Conference *Madison, April 20-22*

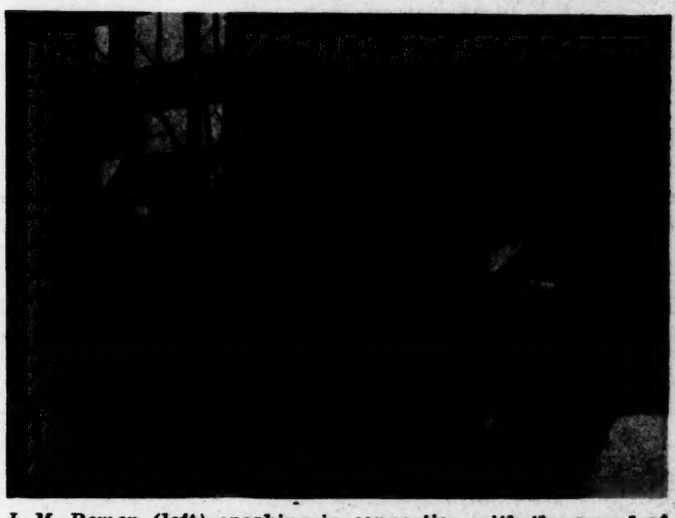


Royal Holbrook, a combustion engineer of Iowa State College, who appeared twice on the Conference program.

At the panel discussion on stoker coals and stokers, A. O. Dady, chief engineer, Schwitzer-Cummins Co.; K. C. Richmond, editor "Coal-Heat" and chairman of the discussion; E. D. Benton, Jacob Best Coal Co., Chicago; W. E. Daugherty, manager of the Milwaukee branch, stoker div., Fairbanks, Morse and Co.



The Wisconsin Bull Hide which was presented to Elmer H. Kelling of the Center Street Fuel Company.



I. M. Remen (left) speaking in connection with the award of the Bull Hide to Mr. Kelling (right).

Flexible Air Conditioning System Installed in French Welfare Center

THE problem of air cooling in conjunction with the central heating and ventilating plant in the child welfare center and day nursery in Suresnes (France) is of interest as it was not simply a question of heating a certain space in winter and cooling it in summer, but of providing for the children at any time of year the physical conditions considered by the doctors to be most favorable. The plant had to comply not only with hygienic requirements, but also with special medical requirements, for it had to be possible to regulate the atmosphere in the rooms into a wide variety of conditions, depending on the judgment of the doctors. The regulation had to be capable of alteration at any time when a change was called for.

The plant installed fulfils this double purpose through the ample capacity of the heating and cooling devices, the particular care which has been devoted to providing automatic regulation of temperature and humidity, and the facility with which the air conditioning can be altered to meet the various demands made on it. The temperatures required in the buildings vary between 65 and 72F, according to the use to which the rooms are put.

While most of the building is heated by forced hot water direct radiators, a large playroom and an artificial beach on first floor are provided with air heating.

In the boiler room are installed three hot water boilers two of which serve the radiators and warm air system while the third is for the domestic hot water supply. Each boiler is equipped with a completely automatic oil burner, control of which is effected by water thermostats, fitted on the two boilers of the central heating plant and on the storage tank of the hot water supply plant. The total capacity of the boilers is about 1,600,000 B.t.u. per hr.

From the boiler room separate pipes lead to the direct heating radiators and to air heaters. The supply mains to the radiators are fitted with devices for mixing the hot water with cold return water, which makes it possible to regulate the temperature of the radiators according to the outside temperature and independently from the air heating system.

The air conditioning plant supplies the large dormitory, the playroom and the artificial beach, which take up nearly the whole of the first floor; the dressing room, the consulting room and the babies' bedroom on the ground-floor. These are all rooms in which an ample quantity of well conditioned air is required through the year in order to maintain the most favorable conditions for comfort and hygiene.

In winter the air introduced is sufficiently moistened to provide a degree of humidity of at least 55% inside the rooms even at the lowest outside temperature. In summer the air is treated in such a way that the inside temperature does not rise above 79F and the degree of humidity at this temperature is 45%.

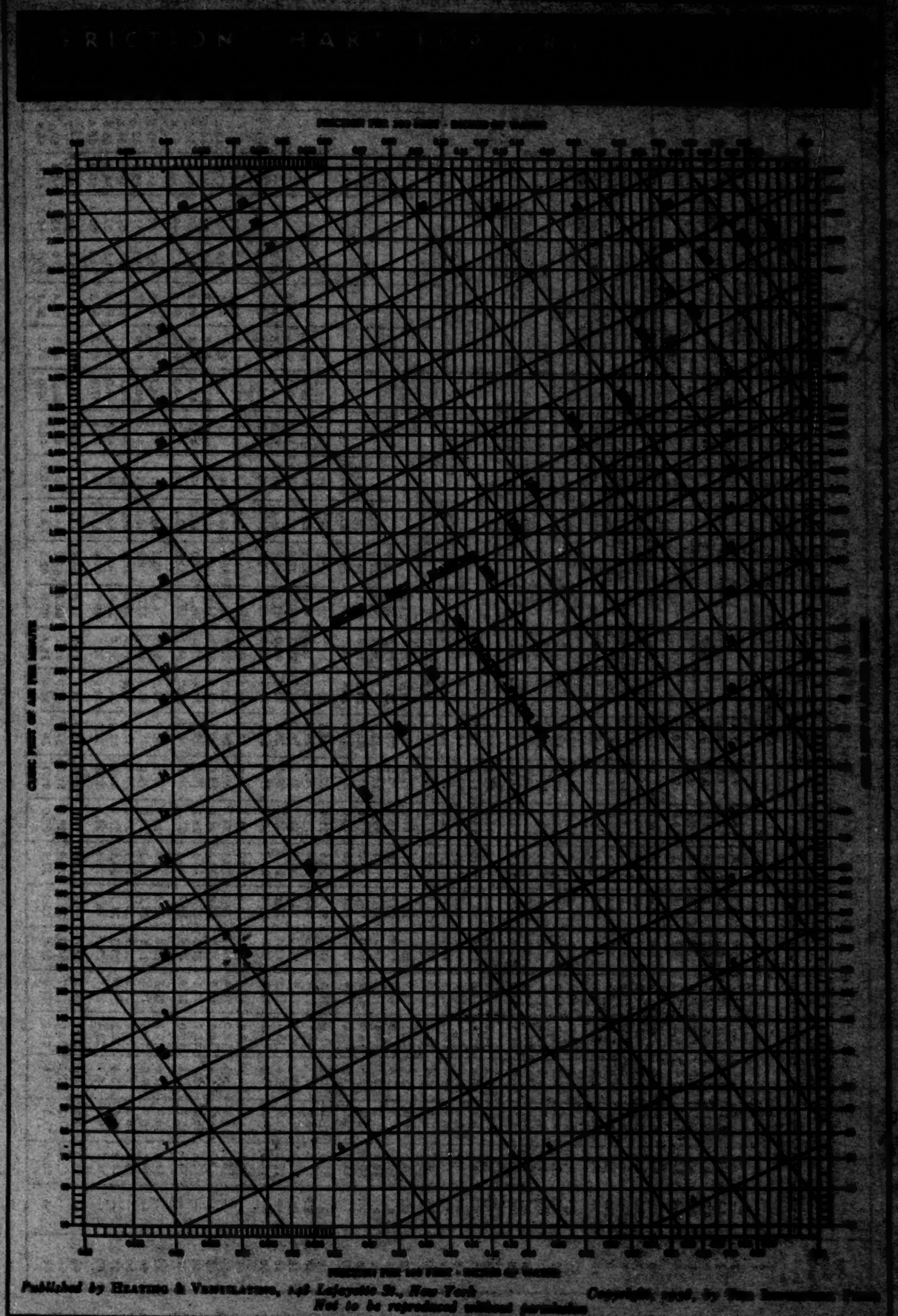
In the rooms treated in this manner, the air is introduced through openings in the ceilings in such a way as to ensure uniform distribution of air without creating any draft. The used air can escape through openings in the plinths. The air conditioning plant comprises an air filter, a conditioning apparatus, a centrifugal fan, an automatic regulating apparatus, and a refrigerating plant.

The conditioning apparatus contains a primary hot water heating coil, an air washing device supplied with heated or cooled water, a secondary hot water heating battery, and two electrically-driven centrifugal pumps for circulating the water in a closed circuit. The air flowing out of the conditioning apparatus is passed into the air ducts by the centrifugal fan and then distributed to the different rooms.

The refrigerating plant cools the water required in summer for the air conditioning. The plant comprises a single-acting compound ammonia compressor with a rated capacity of 200,000 B.t.u. per hr., a shell-and-tube condenser cooled by water from the town mains, and an evaporating coil immersed in the cold water tank. One pump delivers the cold water to the conditioning apparatus where it is sprayed into the air. This water is returned to the tank by a second pump.

The capacity of the air conditioning plant fluctuates greatly, since it depends almost exclusively on outside conditions and extremely hot days are comparatively few in number. For this reason it is preferable, in order to work the plant as economically as possible, that the refrigerating compressor should be of a size suitable for average requirements, and that the additional capacity required for peak demands should be supplied from a cold accumulator. For this purpose the cold water tank has been made of ample size and is carefully insulated, so that it acts as an accumulator and compensates for any fluctuations between the amount of cold demanded and the amount produced. The refrigerating compressor works automatically without attention from the staff.

It should also be mentioned that the water taken from the town mains for cooling the condenser is not lost, but is used afterwards for various purposes in the laundry, garden, and elsewhere.



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H. & V.'s REFERENCE DATA—128

ESTIMATING FRICTION OF VENTILATING DUCTS

Table of Sizes of Round and Rectangular Ducts Having Equal Friction

TABLE 1—EQUIVALENT CIRCULAR AND RECTANGULAR DUCTS WITH EQUAL FRICTION

Other Side of Rectangular Duct, Inches

Diameter of Circular Duct, Inches

Side of Rectangular Duct, Inches	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	22	24	26	28	30	34	38	42	46	48
3	3.0	3.4	3.7	4.0	4.2	4.4	4.6	4.8	4.9	5.0	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.1	6.2	6.4	6.5	6.6	6.8	7.0	7.2	7.3	7.4
4	3.4	4.0	4.4	4.7	5.0	5.2	5.4	5.6	5.8	6.0	6.1	6.3	6.4	6.5	6.7	6.8	6.9	7.0	7.2	7.4	7.6	7.7	7.9	8.1	8.3	8.5	8.7	8.8
5	3.7	4.4	4.9	5.3	5.6	5.9	6.2	6.4	6.6	6.8	7.0	7.2	7.3	7.5	7.6	7.8	7.9	8.0	8.3	8.5	8.7	8.9	9.1	9.3	9.5	9.7	9.9	10.0
6	4.0	4.7	5.3	5.7	6.1	6.4	6.7	6.9	7.2	7.4	7.6	7.8	8.0	8.2	8.3	8.5	8.6	8.8	9.0	9.3	9.5	9.7	9.9	10.2	10.4	10.6	10.8	10.9
7	4.2	5.0	5.6	6.1	6.5	6.8	7.2	7.4	7.7	7.9	8.2	8.4	8.6	8.8	9.0	9.1	9.3	9.5	9.7	10.0	10.2	10.4	10.6	10.9	11.2	11.4	11.6	11.7
8	4.4	5.2	5.9	6.4	6.8	7.2	7.5	7.8	8.1	8.3	8.6	8.8	9.0	9.2	9.4	9.6	9.8	9.9	10.2	10.5	10.7	10.9	11.2	11.5	11.7	12.0	12.2	12.3
9	4.6	5.4	6.1	6.7	7.1	7.5	7.8	8.1	8.4	8.7	8.9	9.2	9.4	9.6	9.8	10.0	10.2	10.4	10.7	10.9	11.2	11.4	11.7	12.0	12.3	12.5	12.7	12.8
10	4.8	5.6	6.3	6.9	7.4	7.8	8.1	8.4	8.7	9.0	9.3	9.5	9.8	10.0	10.2	10.4	10.6	10.8	11.1	11.4	11.7	11.9	12.2	12.5	12.8	13.0	13.2	13.3
11	4.9	5.8	6.5	7.1	7.6	8.0	8.4	8.7	9.0	9.3	9.6	9.8	10.1	10.3	10.5	10.7	10.9	11.1	11.4	11.7	12.0	12.2	12.5	12.8	13.1	13.3	13.5	13.6
12	5.0	5.9	6.7	7.3	7.8	8.2	8.6	8.9	9.2	9.5	9.8	10.1	10.3	10.6	10.8	11.0	11.2	11.4	11.7	12.0	12.3	12.5	12.8	13.1	13.4	13.6	13.8	13.9
13	5.2	6.1	6.9	7.5	8.0	8.4	8.8	9.1	9.4	9.7	10.0	10.3	10.6	10.8	11.0	11.2	11.4	11.6	12.0	12.3	12.6	12.8	13.1	13.4	13.7	13.9	14.1	14.2
14	5.3	6.3	7.1	7.7	8.2	8.6	9.0	9.3	9.6	9.9	10.2	10.5	10.8	11.0	11.2	11.4	11.6	11.8	12.2	12.5	12.8	13.0	13.3	13.6	13.9	14.1	14.3	14.4
15	5.4	6.4	7.3	7.9	8.4	8.8	9.2	9.5	9.8	10.1	10.4	10.7	11.0	11.2	11.4	11.6	11.8	12.0	12.4	12.7	13.0	13.2	13.5	13.8	14.1	14.3	14.5	14.6
16	5.5	6.5	7.4	8.1	8.6	9.0	9.4	9.7	10.0	10.3	10.6	10.9	11.1	11.4	11.6	11.8	12.0	12.2	12.6	12.9	13.2	13.4	13.7	14.0	14.3	14.5	14.7	14.8
17	5.6	6.6	7.6	8.2	8.7	9.2	9.6	9.9	10.2	10.5	10.8	11.1	11.3	11.6	11.8	12.0	12.2	12.4	12.8	13.1	13.4	13.6	13.9	14.2	14.5	14.7	14.9	15.0
18	5.7	6.8	7.8	8.4	8.9	9.3	9.7	10.1	10.4	10.7	11.0	11.3	11.5	11.8	12.0	12.2	12.4	12.6	13.0	13.3	13.6	13.8	14.1	14.4	14.7	14.9	15.1	15.2
19	5.8	6.9	7.9	8.5	9.0	9.5	9.9	10.2	10.6	10.9	11.2	11.4	11.7	11.9	12.2	12.4	12.6	12.8	13.2	13.5	13.8	14.0	14.3	14.6	14.9	15.1	15.3	15.4
20	5.9	7.0	8.0	8.7	9.2	9.6	10.0	10.4	10.7	11.0	11.3	11.6	11.9	12.1	12.4	12.6	12.8	13.0	13.4	13.7	14.0	14.2	14.5	14.8	15.1	15.3	15.5	15.6
22	6.1	7.2	8.3	9.0	9.5	10.0	10.4	10.8	11.1	11.4	11.7	12.0	12.3	12.6	12.8	13.0	13.3	13.5	13.9	14.2	14.5	14.8	15.1	15.4	15.7	15.9	16.1	16.2
24	6.3	7.4	8.5	9.2	9.8	10.3	10.7	11.1	11.5	11.8	12.1	12.4	12.7	13.0	13.2	13.5	13.7	13.9	14.3	14.7	15.0	15.3	15.6	15.9	16.2	16.4	16.6	16.7
26	6.4	7.6	8.8	9.5	10.1	10.6	11.0	11.4	11.8	12.1	12.4	12.7	13.0	13.3	13.6	13.8	14.1	14.3	14.7	15.1	15.4	15.7	16.0	16.3	16.6	16.8	17.0	17.1
28	6.5	7.8	8.9	9.7	10.3	10.8	11.2	11.6	12.0	12.3	12.7	13.0	13.3	13.6	13.8	14.1	14.3	14.5	15.0	15.4	15.7	16.0	16.3	16.6	16.9	17.1	17.3	17.4
30	6.7	7.9	9.1	9.9	10.5	11.0	11.4	11.8	12.2	12.5	12.9	13.2	13.5	13.8	14.1	14.3	14.6	14.8	15.2	15.6	15.9	16.2	16.5	16.8	17.1	17.4	17.6	17.7
34	6.8	8.1	9.3	10.1	10.8	11.3	11.8	12.2	12.6	12.9	13.3	13.6	13.9	14.2	14.5	14.8	15.0	15.2	15.7	16.1	16.4	16.7	17.0	17.3	17.6	17.8	18.0	18.1
38	7.0	8.3	9.5	10.4	11.1	11.6	12.1	12.5	12.9	13.3	13.7	14.0	14.3	14.6	14.9	15.2	15.4	15.6	16.1	16.5	16.8	17.1	17.4	17.7	18.0	18.2	18.4	18.5
42	7.2	8.5	9.7	10.6	11.3	11.9	12.4	12.8	13.2	13.6	14.0	14.3	14.6	14.9	15.2	15.5	15.7	15.9	16.4	16.8	17.2	17.5	17.8	18.1	18.4	18.6	18.8	18.9
46	7.3	8.6	9.9	10.8	11.5	12.1	12.6	13.0	13.4	13.8	14.2	14.5	14.8	15.1	15.4	15.7	15.9	16.1	16.6	17.0	17.4	17.7	18.0	18.3	18.6	18.8	19.0	19.1
48	7.4	8.8	10.0	10.9	11.7	12.3	12.8	13.2	13.6	14.0	14.3	14.7	15.0	15.3	15.5	15.8	16.0	16.3	16.7	17.1	17.5	17.8	18.1	18.4	18.7	19.0	19.2	19.3

Example: From the friction chart it is found that to pass 1500 c.f.m. of dry air at 70° through a 12-in. diameter round duct the frictional loss is 0.36 in. of water per 100 ft. What dimensions must a rectangular duct have to handle this air and produce the same frictional resistance?

Solution: Decide on the dimension of one side of the duct, move horizontally until the round duct diameter is found. Then move vertically and read the other duct dimension at the top. Thus, assume one side of the rectangular duct is to be 10 in. Move horizontally until figure 12.0 is found and then on reading vertically find that other side of the rectangular duct is 12 in. Therefore, a duct 10 x 12 in. is equivalent in friction to a 12 in. round duct. Similarly, other duct sizes can be found which satisfy the friction condition, including a 15 x 8 in. duct or an 18 x 7 in. duct.

$$d = 1.265 \frac{(ab)^{5}}{(a+b)^{2}}$$

where d = diameter, in inches, of a round duct to produce equal friction per foot of length, when carrying the same amount of air as a rectangular duct a inches by b inches in dimension.

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Surveying the Prospect's Premises†

By R. C. BONTHRON‡

Some practical pointers on notes to make when making a field study of the spaces to be air conditioned with special reference to data badly needed in the design rooms but frequently overlooked by the surveyor.

THE future of air conditioning depends largely on costs. This is by no means the only factor but it should be given special consideration when making the survey. Too often a salesman is required to make the survey; if he is not of the inquisitive type a critical survey will not be obtained. The person making the survey cannot be too optimistic. It is most important to get the unfavorable details. It requires careful observation, consideration, and accurate description of the property.

A model investigator is the person of a receptive, impartial mind who can follow a query through and weigh the information secured. He is the most important person contacting the customer. Here is where confidence is established. Zeal tempered with knowledge and a consideration of the purchaser's interest will place him in a very favorable position when the final decision is made; whereas, an arbitrary attitude or indifferent conduct will be rewarded with ill will.

In making a survey for applying air conditioning the following points should be carefully considered:

For What is the Room Used? Obtain this information by observation but definite data must be obtained from the owner. Indicate articles of furniture or permanent fixtures. Commercial establishments, department stores, restaurants, and dress shops, are almost always ready and willing to rearrange the room if business requires it. Make a special note of this.

Of greatest importance is the compass point on the layout sketch. A piece of tracing paper should be used to show basement or upper or lower floors. These dimensions must be correct as they determine the cubical contents and the air changes required.

The location of the space to be conditioned has a direct bearing on the B.t.u. load, such as the sun effect on roof or the temperature difference due to walls, floors, or partitions.

Wall Exposure. Note the word exposure and specify if outside or a partition. There are all sorts and conditions of walls. Many walls, although similar in appearance, differ greatly, and only a thorough investigation will determine the proper transmission factor. Use of the proper factor results in economical application.

Indicate Doors. If the door or doors are in the outside walls, a note should be made of the types of buildings surrounding the space being considered to properly estimate the effect of these buildings on outside air movements in order to determine the proper quantity of air entering space when doors are open.

Ceilings or Roof. Special care must be exercised in obtaining these data, for not only is the material a consideration but the shape greatly affects the heat transfer.

If estimating capacity for cooling and the building is located in a latitude where the sun is directly overhead at noon, then for the maximum load the total area of the roof must be used by the estimator. But with a pitched roof, however, then only that portion of the roof parallel to the sun need be used. In other words, investigate the roof. If it is a heating job being figured, good insulation will prevent loss of heat to atmosphere.

Floors. Construction data are necessary if any additional weight is to be added. If not, material data and the temperature of the space below the floor are the only essentials.

Windows and Skylights. If a room is to be conditioned and outside air brought in, use of windows as ventilators are definitely no longer required. For natural light, they will be required. The investigator should carefully examine them regarding construction and note the fit of the windows in order that the estimator may make recommendations. Sunlight energy coming directly through the windows generally constitutes a considerable percentage of total heat gain, particularly where the walls are of good construction. On this account any effective means of reducing this solar energy without interfering with the original purpose of the windows will be of importance in broadening the application of air conditioning.

Shade. On which side can sun effect be neglected due to shade from surrounding buildings? These are difficult data to obtain. It may require spending long periods of time in the building, but definite data on the subject will pay real dividends.

Adjacent Rooms. Surrounding rooms at other than normal temperature. By normal we mean for the investigator to specify the temperature of these rooms as it greatly affects these estimate data.

Other Sources of Heat in the room.

1. Maximum number of people in room for one hour. The room is being conditioned because of the people therein. Better obtain a commitment from the manager.
2. Obtain all details of motor characteristics and operating period.
3. Lights. These may not be lighted during the day, but a source of heat during the evening. Make note of these data.
4. Electric appliances. Obtain information from nameplates, or if unsuccessful write the manufacturers as these data may not appear on nameplates of equipment in beauty parlors.
5. Number of coffee urns. Make a record of whether gas, steam, or electrically heated.
6. Steam tables. Give the pressure if possible, in addition to other pertinent information.

†From a talk given at East Springfield, Mass.

‡Air Conditioning Div., Westinghouse Electric & Manufacturing Co., New York, N. Y.

7. Any other source—such as steam or hot water pipes, passing through or in partitions.

8. Learn if the heat source is on full, medium, or simmering during the peak hour on which the design is to be based.

Gas-Fired Appliances require a quantity of air for combustion—this quantity may be considered in the infiltration or gas combustion. If hooded, it need only be considered in the infiltration.

Exhaust of Supply Fans. These may be removed after room is conditioned, but if they are to remain accurate nameplate data are necessary.

Electric Current Available. (A) Compressor motor: voltage, phase, and number of cycles. (B) Conditioner: voltage, phase, cycles. In addition, it is always advisable to consult with the local power company to learn if sufficient transformer capacity is available or if a new service is necessary. Never overload the installed service and expect the purchaser to be responsible.

Heating. Better check the source of steam, hot water, or hot air supply, as your equipment may not cover the guarantee unless an ample supply of the heating medium is available.

Is Refrigeration Available for conditioner? Give complete data to enable design engineers to apply proper type of equipment. If water, state source, temperature, and quantity.

Is Cooling Water Available for compressor? How about its temperature, quantity, cost? Better obtain definite data from water company. Because a 2-in. supply is available, this does not signify a sufficient quantity as the present supply may only cover present requirements. Learn if the supply to the condenser will require a meter as this is an item of cost.

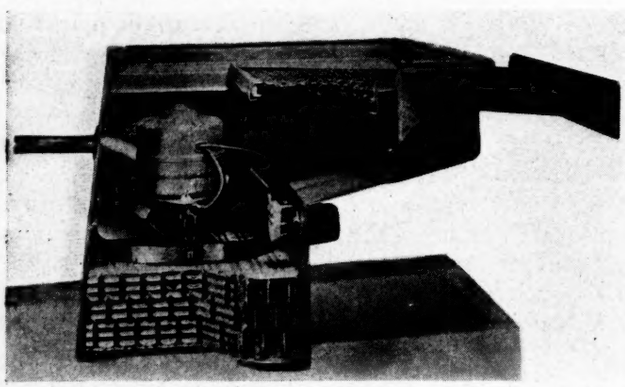
Special Requirements. In addition to notes on the preceding, any special requirements of the purchaser should be stated, such as type of control, type of system, unit or central plant.

Conditioned Air for Automobiles

CONDITIONING of the air in motor cars has long been an important problem confronting automotive engineers. Particularly have the men who design and build automobiles been concerned with improving car ventilating and heating methods, so as to make winter driving more comfortable, healthful, and safe. Keeping cars comfortable in winter has alone been a major problem.

The experiments of one large motor company which has recently brought out a new type of car heating system was described in a recent issue of "The Yale Scientific Magazine." The article was prepared by N. E. Wahlberg, vice-president of engineering, Nash Motors, Kenosha, Wis. Some abstracts from the article follow:

We set out to build a system for motor cars that was similar to air conditioning systems for homes. To make a long story short, we utilized the cowl ventilator (just ahead of the windshield) to scoop in fresh outside air under pressure provided by the forward motion of the car and a powerful fan in the cold air duct to maintain this pressure at low driving speeds. Filtering and heating of that air were then provided for in the manner of air conditioning systems. A natural advantage of the system, we quickly found, was its ability to provide dehumidification sufficient to overcome window and windshield steaming and fogging in winter.



Cutaway view showing at the top, partly removed, the oil-impregnated filter; below, the thick radiator core.

To describe the system, air enters the interior of the car through the open cowl ventilator at a rate greater than that required by ventilation codes governing public buildings. This rate, in most localities, is 25 c.f.m. per person. For example, when the car is traveling at 30 miles an hour, the rate of air intake, conservatively, is 250 c.f.m. If there are six people in the car, this is at the rate of more than 40 c.f.m. per person. What is most important, used air is being expelled from the car interior at the same rate, after a slight pressure has been built up inside. This alone, it is believed, would be considered an outstanding achievement in automobile ventilation. Rates of air intake, at various car speeds, are interesting. For example, when a car equipped with the system is standing still, the fan will deliver 100 cu. ft. of fresh, cleaned, warmed air per minute. When the car is in motion, the fresh air intake increases with increasing speeds as indicated by the following table:

Car Speed	Air Intake, C.F.M.
0	100 (fan only)
30	250 (no fan)
45	400 (no fan)
60	530 (no fan)
70	675 (no fan)

The conditioning system consists of a unit containing an air filter, the aforementioned motor-driven fan, and a hot water radiator with a very deep core of adequate capacity. This assembly is connected with the cowl ventilator by means of a "stack" arrangement which, of course, is completely out of sight, behind the instrument panel. Within the "stack" is a chamber in which the air is moved in a curved path, which action removes water or wet snow. As explained before, when the system is in operation, air is forced in through the cowl ventilator at a rate dependent upon car speed. After the water or snow has been "spun" out and carried off through a drain pipe, the air is introduced into the conditioning unit through an oil-impregnated filter. From the filter, the air travels under pressure past the motor-driven fan, through the hot water heating element, and out into the interior of the car.

INDUSTRIAL EXHAUST VENTILATION

Piping Design

By JOHN L. ALDEN

FROM a pneumatic standpoint, the design of a system of exhaust piping embraces the determination of

1. the static suction at each hood,
2. the air volume entering each hood,
3. the volume rate of flow in each length of pipe,
4. the velocity in each length of pipe,
5. the total air volume to be handled by the fan and
6. the static suction and back pressure at the fan inlet and outlet respectively.

Unless the designer can compute these values with reasonable accuracy, he has no assurance that a given piping system will meet the legal or other predetermined requirements. Neither can he predict the power requirements of the system within the limits of accuracy expected from sound engineering. Earlier sections of this series have described methods for establishing individual losses in hoods, pipes, elbows and fittings. The following pages will develop an orderly procedure for applying these losses to the design of a complete piping system.

Outline of Piping Design Procedure

The preferred design sequence is as follows although some latitude in the order of the various steps is permissible.

1. Sketch a floor plan of the machinery to be exhausted, reasonably close to scale.
2. List the machinery, number and size of branch pipes and the expected minimum suction, velocity or volume at each hood.
3. Make enough freehand sketches of hoods to permit estimation of entry coefficients, listing the latter opposite the machine descriptions in the preceding table.
4. Select the minimum allowable conveying velocity for each section of the system dependent upon the nature of the material to be transported by that section.
5. Compute the approximate volume rate of flow into each hood and add these values to the table.
6. Study the floor plan and sketch one or more possible piping arrangements.
7. Use the volume and velocity lines on the friction chart, Fig. 44, to arrive at approximate branch pipe and main sizes, marking these on the piping sketch together with the air volume flowing in each pipe.

(*Note:* Thus far, no friction computations need be made and all values have been approximate. The sketches need not be accurate. The purpose of the work to this point is to arrive as quickly as possible at a stage where broad overall judgment can be applied.)

8. Inspect the piping sketch to see whether branches originating at some distance from the main should be joined with others, forming sub-mains, to reduce friction; whether the arrangement should be changed to economize pipe sizes; whether building details, machinery or other obstructions interfere with pipe runs whose sizes are now known approximately and to arrive at a final compromise arrangement.
9. Draw the piping scheme finally selected, usually a plan view only, leaving plenty of room for notes covering volumes, velocities, pressures, and similar items.
10. Calculate pressure losses, volumes, velocities and pipe sizes as explained in previous sections and illustrated in the example which follows, recording values on the piping diagram.
11. Check all calculations.
12. Make shop and erecting drawings and prepare bill of material.

Necessity for Systematic Calculation

Flow calculations start at the entrance end of the branch most remote from the fan and proceed step by step through the main and the remaining branches to the fan. The computations are progressive and the values cumulative. Hence, errors in assumptions, methods or arithmetic may reach serious proportions at the fan. Of necessity, therefore, a systematic and orderly method of calculation and tabulation of results must be adopted and followed rigidly. Opportunities for error are so numerous that all computations should be set down in a manner which will facilitate checking.

Data Sheets

The engineer will find it convenient to have all commonly used design information concentrated in one place. Tables and charts may be copied or cut from catalogs and periodicals and pasted on a single large sheet of stiff cardboard or on the slide of the desk. The exact arrangement is unimportant but the data must be instantly available and in such convenient form as to forestall any temptation to guess. The following tables and charts are essential:

Diameters of circles in inches and areas in square feet.

Velocity pressures and corresponding velocities, Fig. 42.

Coefficients of entry, Figs. 37, 38, and 41, supplemented by personal data of the engineer.

Branch pipe sizes and suction for various machines, Table 3 and local exhaust code.

Minimum conveying velocities, Table 5.
Friction losses in straight pipes, Figs. 44 and 46.
Friction losses in elbows, Tables 7 and 9.
Tee losses, Table 10.
Taper losses, Fig. 54.
Weights of piping and elbows.

Calculation of Typical Piping System

The essential pneumatic data of a small pattern shop exhaust system will be calculated. Table 12, columns 1 to 7, lists the machinery to be exhausted together with preliminary estimates of suction and volume as covered by item 2 of the outline. It is assumed that items 1 to 8 have been completed and that Fig. 59 represents the final draft of the piping arrangement. The data in Table 12, columns 3 and 6, are taken from Table 3 or derived from experience. The entry coefficients in column 4 are estimated from hood sketches and Fig. 37. Entry losses, column 5, are derived from column 4 and Fig. 38. The approximate volume, column 7, is read from the alignment chart, Fig. 35. Chart values are amply accurate for the preliminary estimate. The floor sweeps, line 6, are omitted from all calculations because of their intermittent use.

The conveying velocity, line 8, has been taken from Table 5. Pattern shop shavings are dry and light and 3000 f.p.m. is amply high for all pipes. The centerline radii of all elbows have been assumed to be 2.0 diameters. The designer will, of course, use the standards current in his shop. For reasons of economy, the length of all tapers is usually that which will use the full width of the sheet which is standard with the shop. This practice generally produces a long, gradual low-loss taper.

Calculation of flow and pressure starts with branch AF, Fig. 59. This is the only branch at which the hood suction is known with certainty. From the suction, pipe area and entry coefficient the volume, velocity and velocity head can be derived. The pressure drop from the atmosphere at A to the main at F can be expressed in terms of the velocity head. The pressure at F can then be converted from general terms to a specific value in inches of water. The various values are computed as in Table 13 and entered in the appropriate columns. The general form of Table 13 is favored because the detailed but skeletonized notes constitute both the work sheet and the final record. Computations are easily checked from this form. They are then transferred to the piping diagram where their presence aids in visualizing flow conditions in the system.

Branch BF is computed next. The objective is now the hood suction at B, using the known pressure at F as a base. Since the streams AF and BF unite, the pressure at F is common to both and the pressure drop from the atmosphere to F is the same whether measured by path AF or by BF. If the drop in BF be expressed in velocity heads and equated to the drop in AF in inches of water, the velocity head in BF can be determined. Successively the velocity and volume flowing in the branch are derived. The hood suction, already expressed in velocity heads, is next evaluated in inches of water. The remaining branches are treated in the same way. Friction losses in the suction main are read directly from Fig. 44 using the known pipe diameter and volume.

Initially, the only known pressure was the hood suction at A. From this, the pressure at F, the junction with the next branch, was derived. Next, the pressure at hood B was figured, working back from F. Then,

Table 12 – Data for Pattern Shop Exhaust System

COL. No.	1	2	3	4	5	6	7	8	9	10
						Preliminary		Final		
LINE No.	Symbol	MACHINE	Branch Pipe Dia., In.	Entry Coefficient C_e	Entry Loss vel. heads h_L	Suction In. of Water	Approx Volume c.f.m.	Suction In. of Water	Computed Volume c.f.m.	Variation from Preliminary Estimate %
1	Ⓐ	Lathe, 14"x 60"	5	0.78	0.63	1.25	480	1.25	477	0
2	Ⓑ	Jointer, 10"	4	0.82	0.49	1.50	350	1.41	339	-3
3	Ⓒ	Table Saw, 12"	4	0.70	1.03	1.25	270	1.50	300	+11
4	Ⓓ	Band Saw	4	0.65	1.37	1.25	260	1.96	318	+22
5	Ⓔ	Sand Disc, 18"	4	0.80	0.56	1.50	340	1.76	371	+9
6	—	3 Floor Sweeps	6	—	—	—	—	—	—	—
7						TOTAL	1700		1805	+6
8	Minimum allowable velocity in all pipes, 3000 f.p.m.									
9	Elbows, center line radius, 2.0 diameters -									
10	Tees, 45°.									
11	Tapers, length 34 in.									

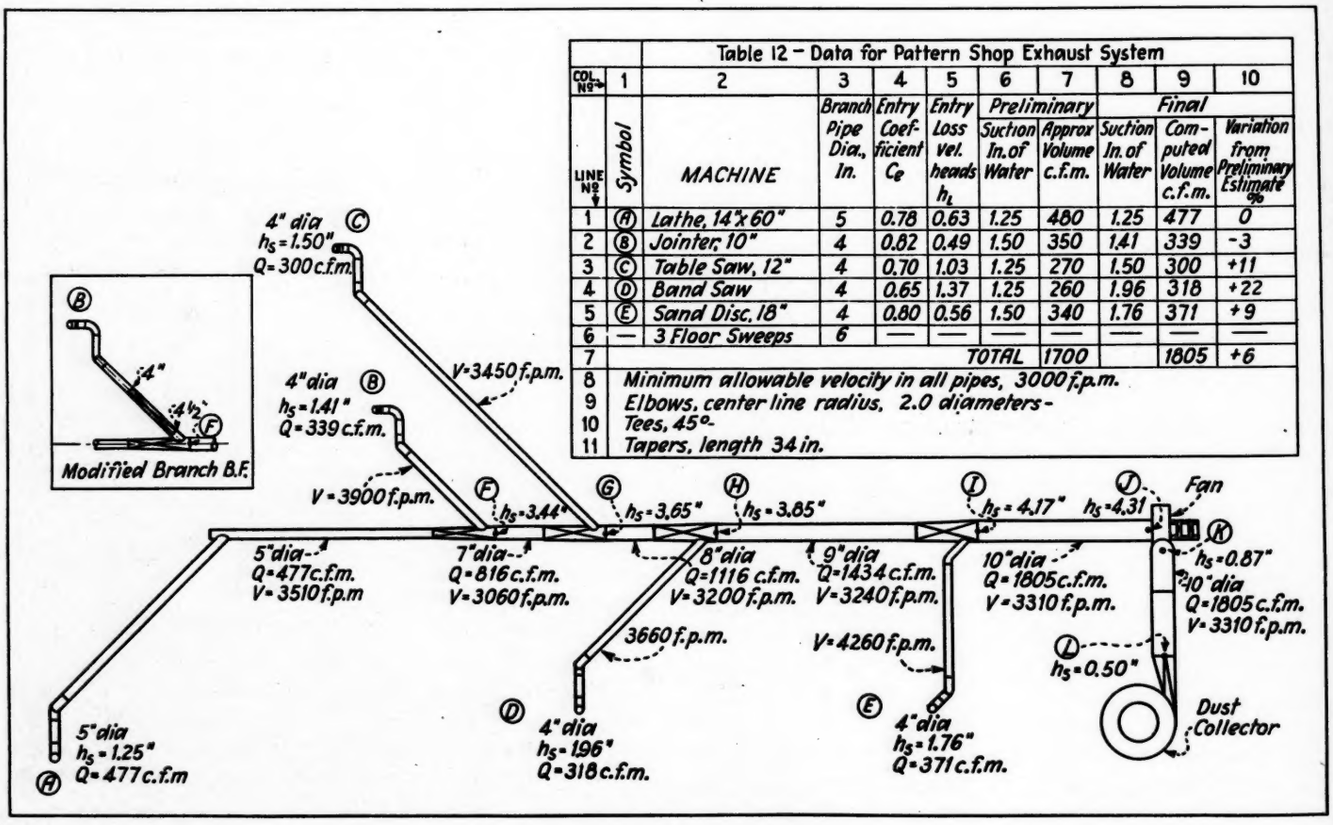


Fig. 59. Pattern Shop exhaust system.

with the combined streams of AF and BF flowing in the section of main, FG, the pressure at the next tee, G, was obtained. From this pressure, the hood suction at C was computed. These steps, branch by branch, were repeated until the fan inlet was reached. For further clarification of the process, the notes in column 8 have been added.

Methods of Increasing Hood Suction

For purposes of comparison with the original estimates, the computed suction and volume for each hood has been entered in Columns 8 and 9, Table 12. It will be observed that the computed suction for hood B falls short of the desired value. Several ways of increasing the suction are available. The most common but least desirable is to raise the general suction level of the entire system until the pressure at the low hood has been brought to the required value. The required suction at B is 1.50 in. of water and the computed suction 1.41 in. The new suction at the fan inlet, J, is

$$h_s = \frac{1.50}{1.41} \times 4.31 = 4.59 \text{ in. of water}$$

The new volume will be

$$Q = \sqrt{\frac{1.50}{1.41}} \times 1805 = 1860 \text{ c.f.m.}$$

The power will be increased about 10%.

If the local exhaust code permits the use of pressure equalizers in the branch pipes, the most economical method of raising the suction at B is to insert fixed resistances in each of the other branch pipes so that the suctions at A, C, D, and E are brought down to the exact levels desired. The air volume passing through the main from G to J is reduced and the friction loss lessened thereby. In consequence, the suction at the tees, F, G, H, and I, is increased. Recalculation of the equalized system shows that, with the fan suction at about 4.30 in. of water, the suction at all hoods will meet the original requirements and the total air moved by the fan will be about 1700 c.f.m. The power will be reduced by about 6%.

Some state laws forbid restriction of branch pipes between the hood and the main. Obstructions in branches also are barred and some states make no exceptions in favor of equalizing dampers. When equalizers are not permitted, the preferred alternative is the reduction of resistance between B and F. The remainder of the system is left as shown in Fig. 59. The elementary resistances in BF include pipe, elbows, and a tee, any of which may be modified to reduce pressure losses. It will be found by trial that the desired reduction in resistance may be attained by enlarging the tee to 4½ in. and by preceding it by a taper of about 3 ft. length. The modified branch is shown separately in Fig. 59.

Branch BF is too near the end of the main to be a favorable location for a vacuum booster. Moreover, the suction at A would be reduced to less than the specified level. The compensating increase in suction at the fan required to overcome low suction at A is no more favorable than that necessitated by the low suction at B.

Table 13. Computations for Pattern Shop Exhaust System.

col.	1	2	3	4	5	6	7	8
LINE Nº	SECTION	Description and Notes	Static Pressure Drop: Friction (Numerical Value)	Static Pressure Drop: Entrance & Elbow Losses & Velocity Head (Minus Sign Understood)	Static Pressure at Junction (Minus Sign Understood)	Volume, Q, c.f.m.: Branch	Volume, Q, c.f.m.: Main	Remarks
1	Branch & Main AF	Entrance - C_e = 0.78, h_t = 0.63 h_v	1.63	-1.25				Col. 3 :- h_s (at hood) = h_v + h_t = (1.0 + 0.63) h_v
2		Pipe - 33' of 5" = 79 dias. h_t = $\frac{78}{79}$ h_v =	1.76					Col. 3 :- From Table 6.
3		Elbows 3 @ 0.21 h_v =	0.63					Col. 3 :- From Table 7 - ells are lumped
4		Tee (dead end main)	0.25					See Final ¶ under "Losses in Tees" †
5		Tee at F	0.20					Col. 3 :- From Table 10.
6		Total Drop A to F	4.47					
7		$h_v = \frac{1.63}{2.09}$ = 0.77", v = 3510 f.p.m. A = 0.136 ♦						Col. 2 :- Velocity from Fig. 42
8		h_s at F = 4.47 x 0.77 =		-3.44	-3.44			
9		Q = 0.136 x 3510 =				477		
10	Branch BF	Entrance - C_e = 0.82, h_t = 0.49 h_v	1.49	-1.41				Col. 4 :- Line 10 :- This is the product
11		Pipe 16' of 4" = 48 dias. h_t = $\frac{48}{49}$ h_v =	1.20					of Entrance loss, Col. 3 & h_v at
12		Elbows 3½ @ 0.21	0.74					Line 16, Col. 2. See Footnote 1
13		Tee at F	0.20					See Final ¶ under "Losses in Tees" †
14		Total Drop B to F	3.63					
15		h_s at F			-3.44			Col. 5 :- From Line 8, Col. 5.
16		$h_v = \frac{3.44}{3.63}$ = 0.95", v = 3900 f.p.m. A = 0.087 ♦						
17		Q = 0.087 x 3900 =				339		
18	Main FG	Pipe 5' of 7"		0.12			816	Col. 4 :- From Fig. 44, Col. 7 + Line 9 + 1 (Col. 8
19		Tee at G	0.15	0.09				Col. 3 :- From Table 10, Col. 4 See Footnote 2
20		A = 0.267 ♦ v = $\frac{816}{0.267}$ = 3060 f.p.m. h_v = 0.58"						
21		Total Drop F to G		0.21				
22		h_s at G			-3.65			Col. 5 = Line 15, Col. 5 + Line 21 Col. 4
23	Branch CG	Entrance C_e = 0.70, h_t = 1.03 h_v	2.03	-1.50				
24		Pipe - 26' of 4" = 78 dias. h_t = $\frac{78}{79}$ h_v =	1.95					
25		Elbows - 3½ @ 0.21 h_v =	0.74					
26		Tee at G	0.20					
27		Total Drop C to G	4.92					
28		h_s at G			-3.65			
29		$h_v = \frac{3.65}{4.92}$ = 0.74" v = 3450 f.p.m. A = 0.087 ♦						
30		Q = 0.087 x 3450 =				300		
31	Main GH	Pipe - 5' of 8"		0.11			1116	
32		Tee at H	0.14	0.09				
33		A = 0.349 ♦ v = $\frac{1116}{0.349}$ = 3200 f.p.m. h_v = 0.64"						
34		Total Drop G to H		0.20				
35		h_s at H			-3.85			
36	Branch DH	Entrance, C_e = 0.65, h_t = 1.37 h_v =	2.37	-1.96				
37		Pipe - 19' of 4" = 57 dias. h_t = $\frac{57}{58}$ h_v =	1.43					
38		Elbows - 3 @ 0.21	0.63					
39		Tee at H	0.20					
40		Total Drop D to H	4.83					
41		h_s at H			-3.85			
42		$h_v = \frac{3.45}{4.83}$ = 0.83" v = 3660 f.p.m. A = 0.087 ♦						
43		Q = 0.087 x 3660 =				318		
44	Main HI	Pipe 12' of 9"		0.23			1434	
45		Tee at I	0.14	0.09				
46		A = 0.442 ♦ v = $\frac{1434}{0.442}$ = 3240 f.p.m. h_v = 0.66"						
47		Total Drop H to I		0.32				
48		h_s at I			-4.17			
49	Branch EI	Entrance - C_e = 0.80, h_t = 0.56 h_v	1.56	-1.76				
50		Pipe - 16' of 4" = 48 dias. h_t = $\frac{48}{49}$ h_v =	1.20					
51		Elbows - 3½ @ 0.21 h_v =	0.74					
52		Tee at I	0.20					
53		Total Drop E to I	3.70					
54		h_s at I			-4.17			
55		$h_v = \frac{4.17}{3.70}$ = 1.13" v = 4260 f.p.m., 0.087 ♦						
56		Q = 0.087 x 4260 =				371		
57	Main IJ	Pipe - 8' of 10"		0.14			1805	To move 1805 c.f.m. fan must
58		Total Drop A to J, h_s at J			-4.31		1805	maintain Static Suction at fan
		(Fan Suction & Volume)						inlet of 4.31" of water
59	Discharge Pipe KL	Pipe - 13' of 10"		0.23			1805	
60		Elbow - 1 @ 0.21 h_v =	0.21	0.14				
61		A = 0.545 ♦ v = $\frac{1805}{0.545}$ = 3310 f.p.m. h_v = 0.68"						
62		Total Drop K to L		+0.37				
63	Dust Collector	Back Pressure		+0.50				Col. 4 :- From Experience
64		Total Drop K to Atmosphere						
65		h_s at K (Back Pressure at Fan)			+0.87			Col. 5 :- Lines 62 + 63, Col. 4 = s.p. at fan outlet

Footnote 1 :- Figure in Column 4 of Line 10 is computed & inserted in the Table after the Values in Line 16 have been computed.

Footnote 2 :- Figure in Column 4 of Line 19 is product of Line 19, Col. 3, & the Velocity head, Line 20, Col. 2

†On page 43, HEATING & VENTILATING, April, 1938.

Checking Design of Purchased Systems

The buyer of an exhaust system will find it advantageous to check the piping design by the same methods as shown in Table 13. By so doing he will determine whether the predicted pressures can actually be attained, whether the velocities in the various sections are adequate to prevent clogging, and whether the pipe sizes and arrangements are the most economical. To make such a check possible, the contractor should furnish hood sketches and estimated entry coefficients, a table of expected suctions and air quantities similar to Table 12, Columns 8 and 9, and a piping diagram simi-

(Concluded on page 74)

Process Steam Piping for

When steam is used for process work, piping follows the general rules used for its application to other steam-using equipment but details must be adjusted as necessary. There is a great variety of steam-using equipment built to meet the needs of cooking, boiling, heating, and drying of which two frequently encountered cases are restaurants and laundries. These two cases are generally typical of many others and illustrations showing how piping is applied to these classes of equipment can be used to show the details and arrangements generally necessary in other similar kinds of application. So also there are cases where special arrangements are necessary, as in removing condensate from a rotating steam drum, and the piping details for a typical application of this kind are included to illustrate the method used.

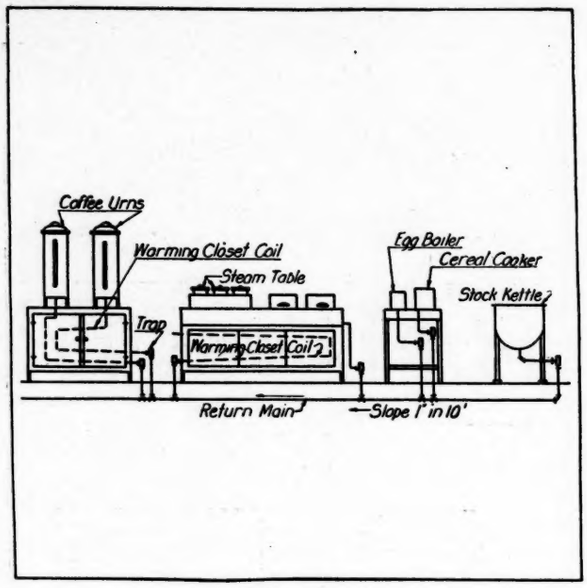


Fig. 1

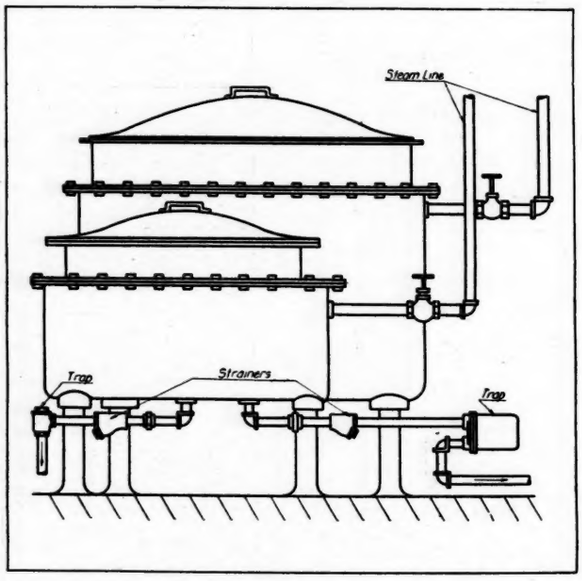


Fig. 2

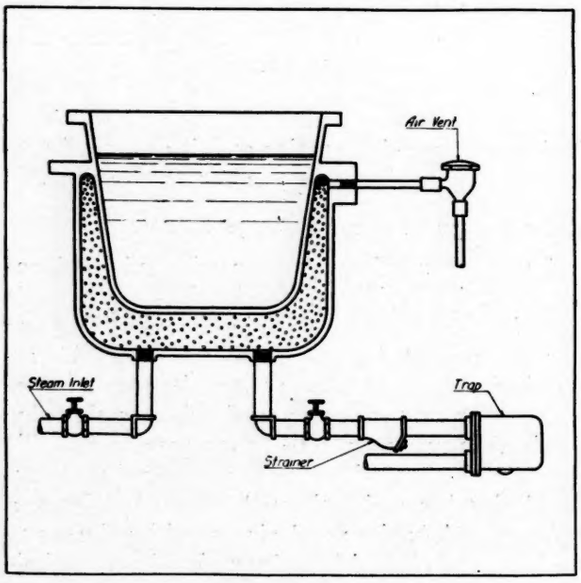


Fig. 3

In practically all applications of piping to steam-using equipment the pressure of the steam to be supplied must be known before the design can proceed. The requirements of the process usually fix the steam pressure, for a fixed temperature is what is required to be maintained and steam at a pressure to maintain that temperature must be available. Usually it is economical to maintain no greater pressure on the equipment than that necessary to furnish the required temperature. For instance, in a laundry mangle it is usually necessary to supply steam at not less than 75 lb. gage in order to evaporate the moisture required and still permit the mangle to turn out full production. On the other hand, food-warming compartments have been successfully operated with steam pressures as low as 5 lb. gage. Steam is not generally considered a suitable medium for process purposes if it is necessary to maintain a pressure of more than 125 lb. gage, and other mediums are used instead when temperatures of more than 350F are required. Below these limits an almost endless variety of process applications are found. It is not possible to tabulate definitely any extended list of the steam pressures required for process purposes for in many cases the pressure used is dependent on the speed or output desired from the appliance. If enough exchange surface is provided and if speed is not a factor, many processes commercially carried out with relatively high pressure steam supply can be accomplished with a much lower supply pressure. Among the processes which commonly need only a low pressure supply of not more than 5 lb. are; scalding and washing with hot liquids kept at not more than 175F to 200F; low temperature cooking such as sausage cooking, milk pasteurizing, soup cooking. What may be called medium pressure processes requiring pressure up to 40 lb. include many food-cooking operations such as vegetable stewing, serving tables, bread glazing, dishwashing with open jets, sterilizing, and like applications. Laundry equipment other than mangles can operate on 10 to 15 lb. steam. Usually in a particular case a decision as to pressure can be best gained by observing existing gages, consulting the operating

Restaurants and Laundries

staff, or by taking temperature measurements direct.

With the supply pressure determined, the question of the amount of steam to be supplied during the peak period must be answered. It is frequently rather easy to estimate by computation, or by inquiring, the *average* amount of steam required to accomplish the desired result. It should be kept carefully in mind, however, that the maximum rate of steam use is seldom less than one and one-half times the average rate and that in many cases the maximum rate is from three to four times the average rate. No specific rules of general application can be given. Frequently the maximum rate must be found from experience or by direct trial.

Pipe sizes necessary to convey a steam supply to equipment can frequently be determined by simply connecting a pipe of the full size of the opening provided on the steam-consuming equipment. Where distances are short and where little is to be gained by more careful methods of sizing this practice can be followed. Where distances are great or where there is an excess of pressure over that necessary at the inlet to the equipment, it may be worth while to size the supply pipe using a liberal pressure drop and following the standard pipe-sizing formulas, like that of Babcock, or tables based on these formulas.

Both supply and return piping should be erected to provide for expansion, and otherwise following good fitting practice. Connections from mains should be so located and sloped that any moisture in the main cannot be carried into the process equipment. Generally branch supply pipes should be dripped for the same purpose. Return piping should be connected to full size of the opening provided and should slope to let the condensate flow by gravity away from the steam-consuming equipment so far as possible. Where traps are used in the return line it is advisable to install a strainer ahead of the trap where this can be done without interfering with the functioning of the trap.

Traps should be used when necessary on the return line in order to keep the equipment free of condensate and conserve the use of steam. When used they should be selected with care both as to type of trap and as to capacity. Care must also be exercised to insure their proper location with reference to both the steam-using equipment and to the return lines.

Pipe arrangements are similar in general to those used in steam-heating systems. Where the steam-using equipment is above the boiler water line the piping arrangement may use gravity return throughout and air valves and vents should be installed. Gravity systems may be of the one-pipe or two-pipe arrangement and the supply lines may be either upfeed or downfeed while the return may be either wet or dry just as with the usual steam-heating systems.

Frequently, however, it is not possible to locate the steam-using equipment above the boiler and in order to return steam in such cases some means of lifting the condensate must be employed. So also it is frequently convenient to attach this kind of equipment to existing steam-heating piping and in such cases the specialties

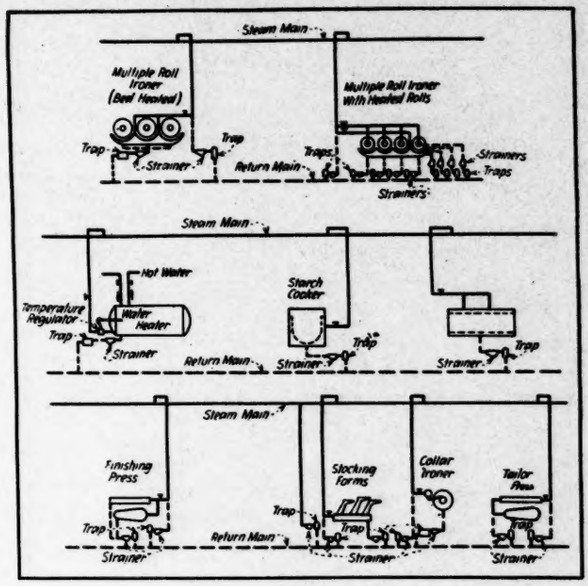


Fig. 4

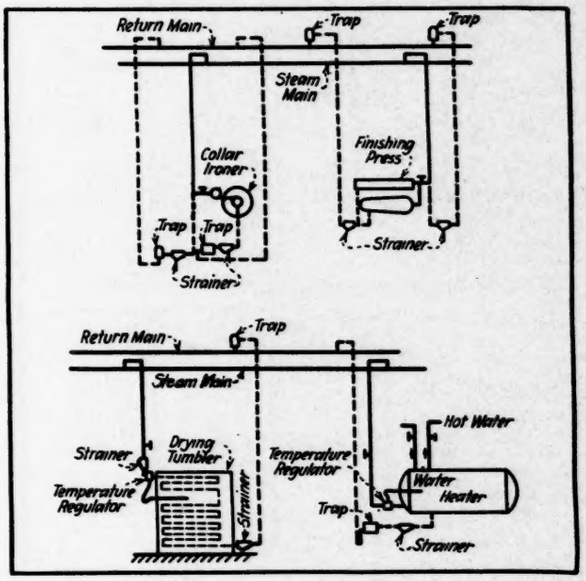


Fig. 5

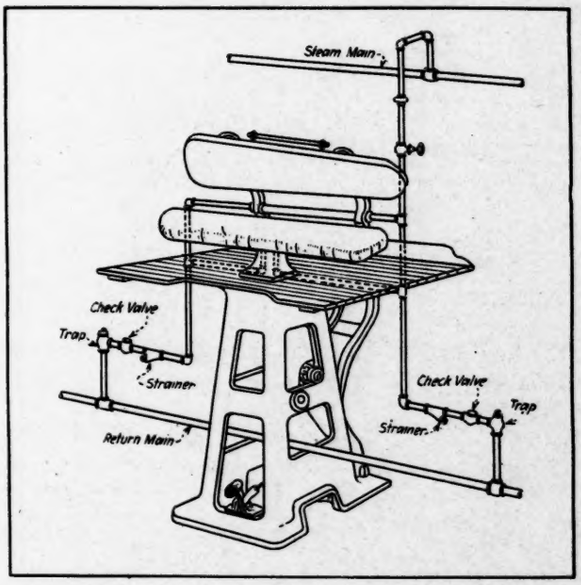


Fig. 6

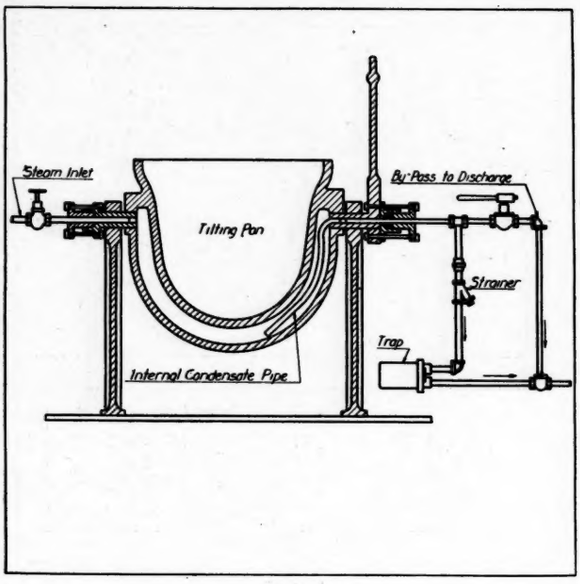


Fig. 7

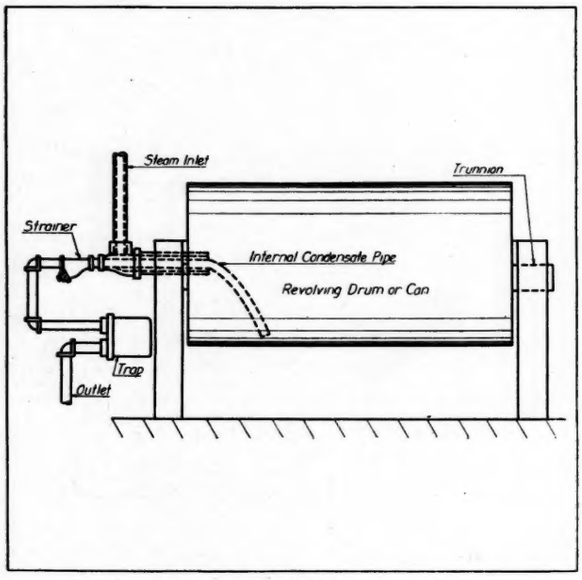


Fig. 8

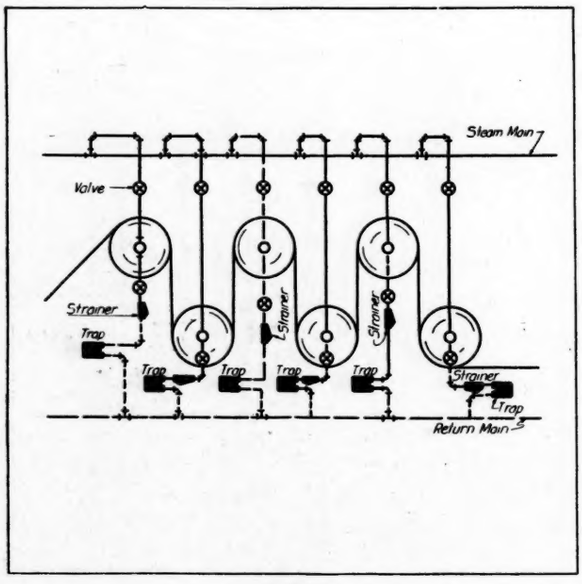


Fig. 9

and fittings used must be of a kind and type which will operate suitably with the heating system. Also in many cases it is necessary to locate both supply and return piping above the level of the steam-using equipment and still return the condensate to the return line. All these cases can be taken care of by a suitable selection of equipment. It will be noted that the accompanying figures illustrate the piping arrangements and relative locations of individual items of equipment when mains and returns are located both above and below the level of the steam-consuming apparatus.

Fig. 1 shows typical items of restaurant kitchen equipment connected to a return main located below the floor and with an individual thermostatic trap for each piece of equipment. The supply line is omitted but might be either upfeed or downfeed.

Fig. 2 shows several steam jacketed pans each having a trap connected to the return line. It is possible with such pans that an air pocket may form near the top of the jacket and slow up the heating of the liquid in the pan. A remedy for this is to connect an air vent near the top of the jacket space as shown in Fig. 3 and thus carry away air collecting in that vicinity. Another remedy consists of changing the design of the jacket, admitting steam near the top and stopping the jacket short of the top of the vessel.

Fig. 4 shows a typical laundry equipment layout where there is a downfeed supply and a return located below the laundry equipment. Here the supply piping is indicated leaving the main at the top, thus avoiding carrying any condensate in the main over into the laundry equipment. The end of the supply main is dripped to the return as is also each vertical pipe. Condensate reaches all the traps shown by gravity and also flows into the return by gravity after the traps open.

Fig. 5 also illustrates typical laundry equipment but in this case both the supply and return piping are located above. Here the condensate flows to the traps by gravity but on passing the traps must be elevated to reach the return main. It will be noted that this sketch also illustrates the point that various kinds of traps may be desirable on the same installation because of differences in operating requirements.

In Fig. 6 is a closeup of the piping connections to a laundry press where the supply piping is overhead and the return is above the floor. It also shows the method of taking off the supply pipe from the main, dripping the supply and returning the condensate through a trap to the return main.

Frequently condensate must be drained out of a revolving drum or pan and must be removed through the trunnion while the steam container is in motion. Cases are tilting pans and revolving drums such as those used for paper drying. Figs. 7, 8 and 9 show details of piping for such applications. Figs. 7 and 8 are closeups showing how a condensate pipe is inserted into the bottom of the container where the condensate gathers. This pipe is located above the trap in the two figures. The condensate passes through the collecting pipe at practically the temperature of the steam. Fig. 9 illustrates the method of connecting the piping between the supply main and the return main where traps and strainers are used in each return line and where a separate trap is provided for each piece of equipment.

Number of Hours an Automatic Intermittent Heating Plant Operates

A hand-fired coal heating plant may be, and usually is, in operation from the beginning to the end of the heating season. Excepting marginal days in the spring and fall, the plant is under fire twenty-four hours per day for the number of days in the season. The system is made to follow, more or less, the fluctuating load upon it by control of the dampers, banking the fire, and similar methods of holding back the rate of fuel burning.

The usual automatic plant using a stoker, oil burner, or gas burner, on the other hand, follows the outside temperature curve by burning the fuel at its maximum capacity for a period, following which no fuel is burned until the inside temperature demands more heat. Consequently, the plant is intermittent in operation through most of the heating season; it burns at its maximum capacity continuously only during the coldest days.

Automatic Plant Follows Temperature

If a heating plant were so designed that its actual output corresponded exactly with the calculated requirements at the outside design temperature, then that plant would operate continuously during waking hours of a day when the outside temperature equaled the design temperature, assuming that the building was one where normal inside temperatures were maintained. Further, if the output of the plant were such that at outside temperatures higher than the design temperature the output would be proportional to the temperature difference, then this plant would perform so as to follow exactly the outside temperature.

Heating plants are usually designed to so operate. Actually, however, they probably rarely live up to design conditions exactly, even when the planning has been most conscientiously done. The heat lag of the building, and sun and wind effects frequently are opposed to close adherence to the outside temperature curve. The plant is usually either over- or under-sized, too, as compared with an exact theoretical standard. However, just as this theoretical standard is useful in design, it is useful in estimating performance.

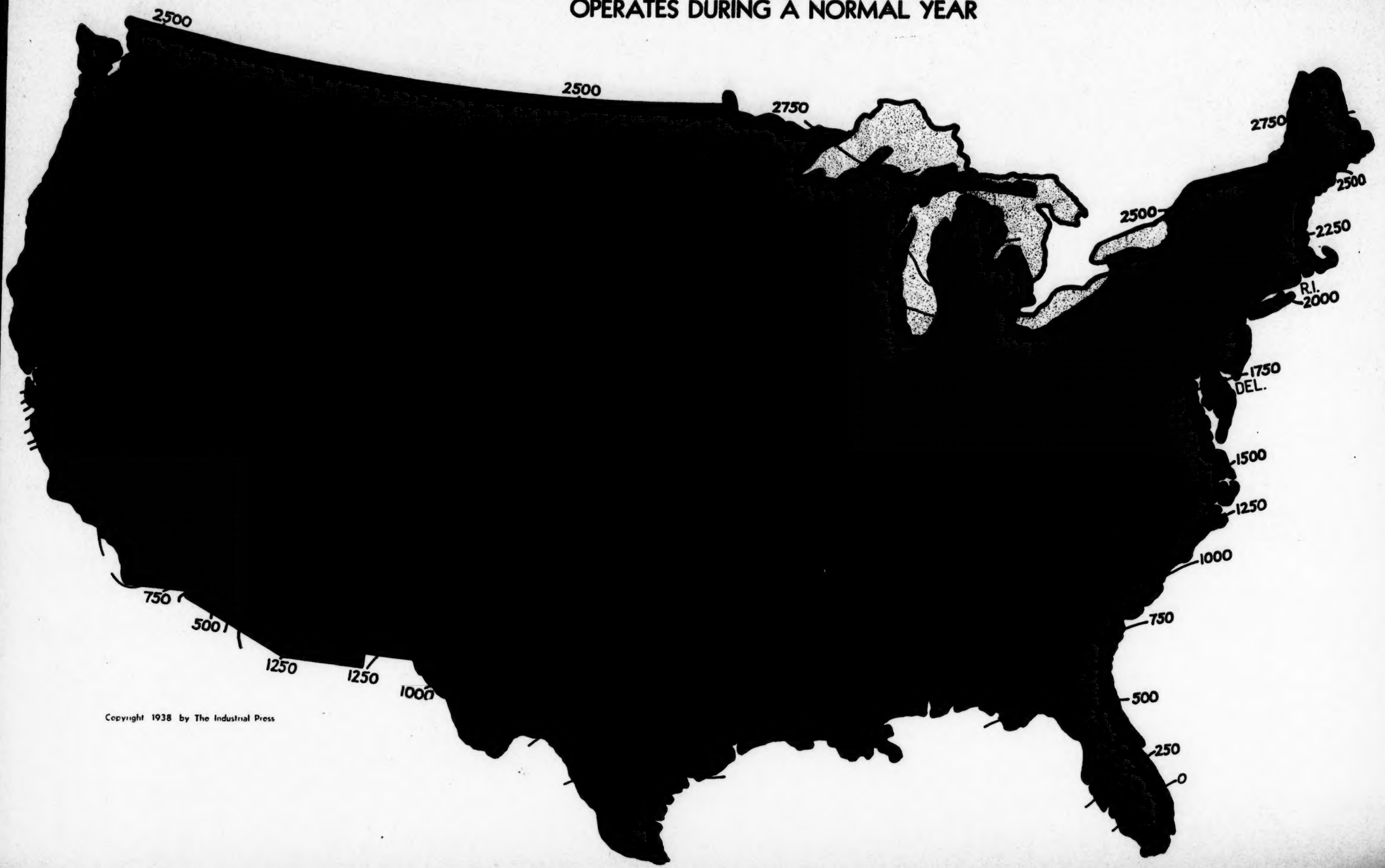
What the Map Shows

The accompanying map and table (for 100 cities) show the calculated number of hours such an automatic and intermittent plant would operate if it were designed to perform as stated above and if the outside temperature for a given locality always followed the average or normal pattern.

Departure from Normal

The number of hours given for each location is the average, or number during a normal year. This number would be greater than given when (1) the plant was under-sized or (2) the season was colder than normal. The plant would operate fewer hours than given if (1)

NUMBER OF HOURS AN INTERMITTENT AUTOMATIC HEATING PLANT OPERATES DURING A NORMAL YEAR



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NUMBER OF HOURS AN INTERMITTENT AUTOMATIC HEATING PLANT OPERATES IN A NORMAL YEAR

City	Hours	City	Hours
Albany, New York	2260	Memphis, Tennessee	1180
Albuquerque, New Mexico	1715	Meridian, Mississippi	940
Atlanta, Georgia	1260	Milwaukee, Wisconsin	2320
Baltimore, Maryland	1810	Minneapolis, Minnesota	2215
Birmingham, Alabama	940	Minot, North Dakota	2420
Boise, Idaho	2050	Mobile, Alabama	705
Boston, Massachusetts	2220	Newark, New Jersey	2150
Buffalo, New York	2340	New Orleans, Louisiana	615
Burlington, Vermont	2400	New York, New York	1970
Butte, Montana	2335	Norfolk, Virginia	1560
Charleston, South Carolina	945	Oklahoma City, Oklahoma	1240
Charlotte, North Carolina	1360	Omaha, Nebraska	1960
Cheyenne, Wyoming	2105	Paterson, New Jersey	1840
Chicago, Illinois	2010	Pensacola, Florida	665
Cincinnati, Ohio	1615	Peoria, Illinois	1955
Cleveland, Ohio	2110	Philadelphia, Pennsylvania	1940
Columbia, South Carolina	1140	Phoenix, Arizona	845
Columbus, Ohio	1725	Pittsburgh, Pennsylvania	1800
Concord, New Hampshire	2075	Portland, Maine	2240
Dallas, Texas	985	Portland, Oregon	2150
Denver, Colorado	1655	Providence, Rhode Island	2220
Des Moines, Iowa	1915	Pueblo, Colorado	1470
Detroit, Michigan	2395	Reading, Pennsylvania	1850
Duluth, Minnesota	2530	Reno, Nevada	2010
El Paso, Texas	1060	Richmond, Virginia	1630
Erie, Pennsylvania	2320	Rochester, New York	2310
Eugene, Oregon	2340	St. Louis, Missouri	1675
Evansville, Indiana	1565	Salt Lake City, Utah	1910
Fitchburg, Massachusetts	2120	San Antonio, Texas	640
Flagstaff, Arizona	2140	San Diego, California	1320
Fort Smith, Arkansas	1400	San Francisco, California	2610
Fort Wayne, Indiana	1895	Savannah, Georgia	715
Frederick, Maryland	1690	Scranton, Pennsylvania	1960
Grand Forks, North Dakota	2600	Seattle, Washington	2165
Grand Rapids, Michigan	2090	Shreveport, Louisiana	930
Great Falls, Montana	2040	Sioux City, Iowa	1940
Greensboro, North Carolina	1695	Sioux Falls, South Dakota	2160
Hartford, Connecticut	2075	South Bend, Indiana	2140
Houston, Texas	695	Spokane, Washington	2030
Huntington, West Virginia	1620	Springfield, Illinois	1720
Indianapolis, Indiana	1820	Syracuse, New York	2065
Jacksonville, Florida	535	Topeka, Kansas	1700
Kansas City, Missouri	1670	Trenton, New Jersey	1970
Knoxville, Tennessee	1600	Tulsa, Oklahoma	1220
Lexington, Kentucky	1705	Vicksburg, Mississippi	875
Lincoln, Nebraska	1920	Washington, District of Columbia	1710
Little Rock, Arkansas	1115	Wheeling, West Virginia	1790
Los Angeles, California	1035	Wichita, Kansas	1605
Louisville, Kentucky	1540	Wilmington, Delaware	1915
Madison, Wisconsin	2375	Yuma, Arizona	550

TABLE 1—MAXIMUM AND MINIMUM ANNUAL NUMBER OF HOURS OPERATION OF HEATING PLANT

(Figures in the preceding table are long-time averages. Figures in this table are based on the coldest and warmest seasons during the last ten years and apply only to intermittently operating devices.)

City	Maximum	Minimum	City	Maximum	Minimum
Albany, N. Y.	2440	1960	Milwaukee, Wis.	2440	1890
Atlanta, Ga.	1430	945	Minneapolis, Minn.	2540	1920
Baltimore, Md.	1910	1390	Nashville, Tenn.	1645	1170
Birmingham, Ala.	1170	710	New Haven, Conn.	2140	1720
Boston, Mass.	2410	1900	New Orleans, La.	860	395
Buffalo, N. Y.	2530	2040	New York, N. Y.	2100	1640
Chattanooga, Tenn.	1700	1130	Norfolk, Va.	1760	1175
Chicago, Ill.	2230	1680	Oklahoma City, Okla.	1370	1025
Cincinnati, Ohio	1920	1400	Omaha, Neb.	2310	1700
Cleveland, Ohio	2220	1720	Peoria, Ill.	2150	1560
Columbus, Ohio	1890	1435	Philadelphia, Pa.	2000	1500
Dallas, Tex.	1165	845	Pittsburgh, Pa.	1965	1570
Denver, Colo.	1775	1200	Portland, Me.	2440	2030
Des Moines, Iowa	2190	1680	Providence, R. I.	2350	1925
Detroit, Mich.	2610	2000	Reading, Pa.	1915	1540
Duluth, Minn.	2820	2260	Richmond, Va.	1850	1330
El Paso, Tex.	1200	845	Rochester, N. Y.	2440	1965
Erie, Pa.	2480	1980	St. Louis, Mo.	1830	1230
Evansville, Ind.	1820	1240	San Francisco, Calif.	2460	1630
Ft. Wayne, Ind.	2180	1660	Scranton, Pa.	2100	1720
Grand Rapids, Mich.	2260	1800	Seattle, Wash.	2310	1635
Hartford, Conn.	2240	1825	Spokane, Wash.	2220	1585
Indianapolis, Ind.	2100	1530	Syracuse, N. Y.	2140	1720
Kansas City, Mo.	1930	1430	Toledo, Ohio	2340	1795
Los Angeles, Calif.	1040	455	Trenton, N. J.	2315	1760
Louisville, Ky.	1840	1305	Utica, N. Y.	2285	1950
Memphis, Tenn.	1460	890	Washington, D. C.	1765	1345

the system were over-sized or (2) the season were warmer than normal. For certain combinations of over-sized plant and cold winters (or vice versa) the figures as tabulated would again apply.

Usefulness of the Data

As given the figures show the hours of operation per normal season of oil burners, stokers, and gas burners where they are of the intermittent type and under automatic control; the figures also apply to such auxiliary devices as forced air heating plant fans where they are of the on or off type controlled directly by a simple thermostat.

The table for 100 cities lists the number of hours of operation for normal winters. Table 1, supplementary to the main table, shows the maximum and minimum hours of operation based on outside temperature for the last ten winters.

Vapor Barriers in Building Construction

By L. V. TEESDALE†

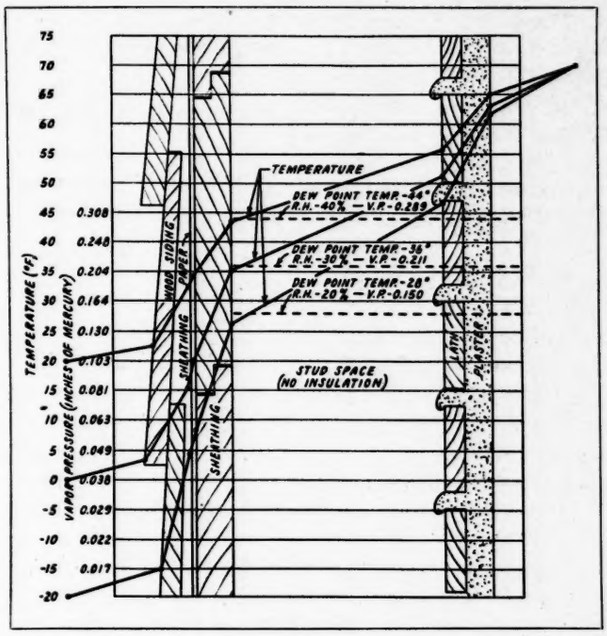

Fig. 1. Diagram showing the fall in temperature across a frame construction sidewall

MOISTURE accumulation within a wall like that illustrated in Fig. 1 is affected by five factors:

1. Outside temperature and humidity.
2. Efficiency of insulation.
3. Inside atmosphere (temperature and humidity).
4. Resistance of outer wall to vapor movement.
5. Resistance of inside wall to vapor movement.

As the outside temperature and humidity cannot be controlled and as insulation adds to comfort, health, and fuel economy, methods of prevention are limited to the three other factors. Some authorities believe that indoor humidities low enough to preclude the possibility of moisture accumulation are undesirable both as a factor of health and comfort and in preventing the overdrying of interior woodwork and furniture. It is possible, of course, to compromise and carry somewhat lower humidities during very cold weather than are maintained during moderate winter weather. It is also possible to so construct walls that the vapor could pass outward through sheathing and sheathing paper and escape through openings in the outside wall covering or be carried away by ventilating the space between the sheathing and outside finish. Standard construction does not lend itself to this method of moisture elimination. Either the inclusion of ventilating holes in the side wall material or a ventilating space would require more or less modification of the conventional construction. One possible method for wood siding would be to place 1 by 2 in. furring strips over the sheathing, thus obtaining a vertical ventilating space approximately ¾ in. which should be open to the outside at both the bottom and top of the wall so that air could enter at the bottom and pass out at the top. The openings could be concealed behind but not covered by moldings or other treatment at the water table and cornice. Similar ventilation could be adapted to stucco, brick, and stone exteriors. With this method the sheathing paper should be of a type that passes water vapor readily, such as slaters felt. During periods of protracted cold weather it is quite possible that moisture would accumulate in the wall faster than it could pass through and be removed by ventilation, hence the ventilation method might not assure complete protection. So far, the possibilities in this method have not been thoroughly investigated by the Forest Products Laboratory.

Attics under pitched roofs can often be ventilated either through windows or louvered openings, ventilators in the roof, or openings in chimneys. Wood shingle roofs when laid on roof boards that are separated about two inches will often allow enough ventilation in the attic to eliminate the moisture problem. Flat roofs are more of a problem. Where the ceiling joists or supports and roof joists or supports are separated enough to allow a free circulation of air, and where sufficient openings and vents are installed a fair degree of ventilation can be obtained. Often the space under flat roofs is not sufficient to obtain adequate circulation.

The most positive, and least expensive, method of control so far experimented with at the Forest Products Laboratory is the use of vapor resistant barriers at or near the inner face of the wall and under ceiling joists under the attic. In houses under construction this barrier can be attached to the inner face of the studs after the walls have been insulated and before lathing or finishing the wall on the inside. In houses already plastered the barrier can be some suitable material or treatment applied to the interior surface of exterior walls. While it might appear on first thought that such a barrier should be 100% resistant, actually, however, it is not practical to obtain 100% efficiency. With a suitable barrier, however, the amount of moisture entering the wall is so small that it will not raise the moisture content to a degree that is objectionable.

The Forest Products Laboratory has been making tests on the vapor resistance of various materials used in wall construction and also on many materials that might be used for moisture barriers. Although these tests are still under way and have not covered all possible materials, enough information is available to permit the selection of a number of materials that are highly resistant to the passage of water vapor. Among these are (1) asphalt impregnated and surface coated sheathing paper, glossy surfaced, weighing 35 to 50 lb. per roll of 500 sq. ft.; (2) laminated sheathing paper

†Senior Engineer, Forest Products Laboratory (maintained at Madison, Wis., in cooperation with the University of Wisconsin), Forest Service, U. S. Department of Agriculture.

made of two or more sheets of kraft paper cemented together with asphalt; (3) double-faced reflective insulation mounted on paper. The water-vapor resistances of these three materials, as measured at the Laboratory, differ considerably one from another. Unfortunately, the work has not progressed far enough yet to enable a definite statement of the precise degree of vapor-resistance required for any specific set of conditions. Most of the discussions and recommendations in this preliminary article are based upon a climate such as that of Madison, Wis., and upon plastered wood construction. The recommendations have not yet been subjected to actual service tests, and may have to be modified as time goes on.

The barrier when located as described on the warm side of the dewpoint position resists the passage of moisture while it is in the form of vapor and therefore before it has a chance to condense into water. Hence there is no hazard of water forming behind the plaster or other interior wall finish. The barrier also prevents moisture from getting into the wall or attic space during the construction period, particularly during the plastering operation.

Such vapor barriers should be applied vertically on side walls with edges lapping on the studs after the insulation is installed and before lathing. Horizontal joints should be made only where backed up with a plate or header. The barrier should be brought up tight against electric fixture outlets, air registers, door and window frames, and other similar openings. If wood lath, metal lath, or other types requiring a plaster key are used the paper should be applied slightly loose so that the plaster can push the barrier back to form the key. Where the ceilings below the attic or roof are insulated the barrier should be applied in a similar manner.

Walls finished with such materials as plywood, fiber board, plaster board, and the like, should also have the barrier as described. Sheathing paper when used outside of the sheathing in combination with the moisture barriers described should be water-resistant but not very vapor-resistant so that the small amount of water vapor that may leak through the barrier can escape outward. Slaters felt meets this requirement. Quite possibly the sheathing paper could be omitted entirely; and it is conceivable that the omission would actually result in a drier wall. Further experiments will have to be made before this point can be definitely settled.

General Recommendations

For new construction it is recommended that a suitable vapor barrier be installed on the sidewall studs and below the ceiling insulation and that some attic ventilation also be provided. This will not only protect the house for normal humidities but should prove ample protection in case winter air conditioning is installed. Further, it offers protection during the construction period, particularly if plastering is done in cold weather.

For existing houses that have been or are to be insulated, and where humidities during cold weather are low, attic ventilation alone should be adequate. Should evidence of moisture appear in mild weather following a cold period, cut off all possible sources of humidity for the balance of the winter and some time later in the following summer, after the moisture has had time to disappear, coat the exterior walls and the ceiling below the roof insulation with two coats of aluminum paint after which redecorate as desired.

For existing houses that are equipped for winter air conditioning follow the foregoing suggestions and during periods when outside temperatures are below 15F carry relative humidities not higher than 30% and in sub-zero weather reduce to 20% relative humidity.

The suggestions offered here are based upon tests now under way at the Forest Products Laboratory combined with observation and experience in occupied homes. As these tests and observations are continued and additional information becomes available more specific recommendations for protection against moisture condensation will be forthcoming.

Air Conditioning Proves Stimulant to Summer Business

AIR conditioning has become an important aid to business. Comfort for customers and for employes pays dividends, said A. D. McLay of Detroit Edison Company in a recent address before the Sales Conference of Edison Electric Institute.

Mr. McLay reports results of a survey which covered every user of air conditioning, both industrial and commercial, in the city of Detroit. Each was asked, "To what extent has air conditioning increased your summer business?" Tabulation of the replies showed the following: 4% said it had increased business 100%; 6½% said it had increased business 50%; 3% said it had increased business 35%; 42% said it had increased business 25%; 9½% said it had increased business 20%; 3% said it had increased business 15%; 22½% said it had increased business 10%.

Discussing the advantages which air conditioning had brought them, 97% of these business concerns said that customers had mentioned relief from the heat of the street; 49% considered the elimination of dust and dirt as the chief asset; decreased spoilage and fewer "rejects" were important gains cited by 12% of the concerns; and 38% mentioned the elimination of noise.

The latter advantage, Mr. McLay points out, is one which alone is often worth the cost of air conditioning installation. Noise and dust of city streets can by this means easily be shut out of homes and commercial establishments where values have depreciated because of noise or dust annoyances.

"This phase was summed up by the National Resources Committee last year," Mr. McLay says, "in its report on technological trends and national policy. The Committee declared that 'Air conditioning, which was first applied in factories for the benefit of the goods, is likely to be extended gradually as it becomes cheaper and as more thought is given to the efficiency and comfort of the worker. With air conditioning will come also better insulation against noise.'"

EDITORIALS

Chemical Drying of Air

Technical interest in the drying of air by chemical means for use in comfort air conditioning is showing every sign of a steady growth. We have repeatedly called attention to the possibilities which this method seems to hold for such purposes. Others have also taken an active interest in the subject and several methods of applying the idea to comfort jobs are now in existence. Most of the present applications are for process work in industry but behind it all there is a steady effort to adapt the methods to the requirements of comfort work. There are even now some engineers who are so bold as to state that they believe that adequate air drying without much lowering of the dry bulb temperature will be the direction in which residential summer cooling will move. At any rate it is pretty evident that the chemical air driers are about to be examined and re-examined to see what promise they really do hold for comfort cooling. What will come out of all the study and examination is one of those uncertainties which still make summer cooling for comfort such a fascinating subject to a growing body of engineers.

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Cooled Buses Appear

In this issue is information about the first extensive applications of summer cooling to cross-country buses. Adoption of cooling by bus operators was foreshadowed just as soon as the railroads began to use it and found that the public reaction was favorable. Acceptance for buses waited largely on convincing the owners and operators that the equipment available for the purpose was suitable, dependable, and otherwise desirable. Much experimenting has been reported from time to time. If experience in other applications means anything one may expect to see buses continually use more and more cooling from now on. One of the notable features in the growth of the whole cooling business has been its rapid spread once a few successful pioneer installations are made in any given field. Competition then quickly drives the others in.

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Progress in Product Design

In the design of metal products it is generally accepted as a true statement that unit weight reductions reflect progress. Usually the early designs are heavy, cumbersome, clumsy, and reflect the factor of fear brought about by not knowing just what to expect. As time goes on, as experience is collected, as new methods and materials come to light, the weight reduction goes on. That is why metal product designers often review their early designs to see what they have accomplished.

What brings this to mind at present is the receipt of statistics indicating that the refrigerating compressor has experienced a weight reduction to one-sixth of that necessary thirty years ago. Of course some of this weight reduction has been due to a changed refrigerant and is not all creditable to reduced metal. At any rate it is a striking weight reduction.

But so also have other metal products in this field been greatly reduced in weight over this same period. Think of what the old style radiator used to weigh, the old coil blast heater, the slow-speed fan wheel, the old boilers and furnaces. Even the weight of piping has been reduced for its carrying capacity has been increased. It is safe to estimate—lacking specific figures—that the whole weight of good heating and cooling installations at present is substantially less than that of a one-function installation of thirty years ago. If weight reduction is a true index of progress then the product designers in this field can be proud of their record and can regard themselves as truly progressive.

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More Light on the Body Heat Loss Problem

Evidence of the great assistance which engineers can receive from physicians in securing a more fundamental knowledge of how the body generates and dissipates its heat is appearing now almost monthly. Scarcely does a meeting of medical men pass without some reports shedding light on problems which troubled engineers.

Much of this is due to the increased interest of physicians in the body heat problem which has accompanied the rise of air conditioning to popularity, while a considerable part is also due to the rapid rise of experimental research in medicine and anatomy with the advent of newly discovered tools with which to work.

One of the latest reports comes from a Pittsburgh meeting of anatomists where a research worker reported that by stimulating a certain area of the brain with high frequency electrical impulses he could cause subjects to perspire and increase their breathing in a cold atmosphere and could cause them to shiver in a hot atmosphere. Here is evidence that the human brain does function to govern heat dissipation from the body in accordance with the impulses which it receives. It also tends to confirm the belief that the brain impulses are electrical in nature.

The possibilities opened up by such a localization of impulse and a knowledge of how to create the motivating impulse are tremendous. Wholly aside from a contemplation of what the new knowledge *might* lead to is the thought that as the mechanism governing body heat dissipation becomes better understood the engineer is able to apply his heat determination more intelligently and with more confidence. Finally, at some perhaps distant date, he may be able to localize his heat treatment of the body to produce comfort to much better advantage than he can at present. All this study of the body heat mechanism by physicians is a welcome effort so far as engineers are concerned. We have always felt that they were the ones who should do such experimenting but their active interest has been aroused only in recent years. Now that they are active, it is to be expected that we will continue to learn more and more from them.

KINKS

Unit Heaters Overcome Poor Heat Distribution

In a building used for a gymnasium and indoor field four unit heaters were installed to compensate for a lack of heating capacity and to heat the building to a temperature of 65F more quickly.

It was planned to place the unit heaters in the corners of the building at a height of 14 ft. above the floor. Already built into each corner of the building were four ventilation ducts 3 ft. square exhausting to the roof with an inlet opening near the floor. The company selling the heaters recommended that these ventilation ducts be connected by a leader to the unit heaters and that their heater fans (propeller type) would pull the cold air off the floor and circulate it through the heaters. This theory sounded good because it had previously been found that the air near the floor was very cold while several feet above the floor the air was at a comfortable temperature.

Before the circulation ducts were connected steam was turned in and a few tests were run to compare the warming up period with that of the former system. Very satisfactory results were obtained. Under comparable conditions, not only did the building heat up to 65F, where before a temperature that high was near impossible with the outside temperature 20F or lower, but the warming-up period was reduced about two and one-half hours.

The heaters were then hooked up to the ducts in the recommended style and the building was heated but very little better than before the installation of the heaters, and not nearly as well as before the heaters were connected to the air ducts. The heaters did not circulate as much air out from the floor as before, although directly in front of the heater coils, the velocity of the air was satisfactory. The poor circulation was caused by the use of a propeller fan which is not adapted to overcoming the resistance of air flow through a duct. The friction of the duct was too great for the fan to overcome and although there seemed to be hot air discharging from the heater, in reality, a large amount of the air was recirculated re-entry air. The air was being discharged in the area near the center of the heater surface and on the outer surface the direction of flow of the air was in the opposite direction. That is, the air in and about the heater was more or less in equilibrium; thus decreasing the efficiency of the heater. After removing the leaders from the heaters the system again performed in a satisfactory manner.—*D. F. H., Lafayette, Ind.*

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Liberal payment will be made for brief articles which are, in the opinion of the editors, useful and generally applicable kinks relating to drafting room, shop, plant, or field practice in the design, installation, operation, or maintenance of heating, ventilating, or air conditioning equipment. Sketches (in pencil) or photos should be included when necessary.

THE MONTHLY QUIZ

How many of the following teasers can you answer offhand? Only one of the answers given after each question is correct. Check your answers against those appearing on page 64

1. A cast-iron warm-air furnace designated as a 24-in. size is one whose (1) radiator is 24 in. in diameter (2) grates measure 24 in. in diameter (3) firepot at the top measures 24 in. (4) flue must be 24 in. in diameter (5) casing is 24 in. in diameter.

2. A micron is (1) an extremely accurate Pitot tube (2) a millionth of a meter (3) a thousandth of an inch (4) a very sensitive element of an electric control (5) a measure of electrical resistance.

3. Louvre is (1) a type of shutter to control air flow (2) a metric unit of volume (3) a museum (4) a French term for air velocity (5) the pitch of a propeller-type fan.

4. The term adiabatic designates variations in volume and pressure of a gas with (1) no change in the absolute humidity (2) no change in the relative humidity (3) no change in the heat content (4) no change in vapor pressure (5) no change in temperature.

5. Heat resistivity is the (1) quantity of heat which flows through a unit area of material under a unit temperature gradient in a unit of time (2) ratio of the friction of a hot gas flowing in a duct or pipe to the friction of the gas at a standard cool temperature (3) the reciprocal of conductivity (4) the resistance to heat flow of a surface film (5) a type of heat insulator.

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A Reader Wants to Know

A subscriber is anxious to know the names and location of any air conditioning installations in which city water is used and then pumped back into the city water mains.

Any such information which can be furnished will be greatly appreciated by HEATING & VENTILATING and will be promptly forwarded to the inquirer.

THE PROBLEM CORNER

The residence of a certain New York engineer is located a considerable distance from the nearest railroad station. Since his methods are efficient, he has arranged for his wife to leave the house every night at the same time and drive at a stated speed to the station where she arrives just in time to pick up her husband and then takes him home at the same speed.

One evening, however, this engineer completes his work early and catches a train which arrives at his station one hour sooner than his usual train. He starts to walk toward home, and his wife meets him part way home and thus is able to get him to his house thirty minutes earlier than usual. For how long a time was the man walking?

If you are doubtful of your solution, the problem is solved on page 64.

ABSTRACTS of Current Papers, Books and Pamphlets

Graphic Instruments

Graphic instruments are daily becoming more established in industry and have resulted in increased productive capacity and efficiency. To help engineers and executives make more extensive and valuable use of these devices, The Esterline-Angus Company has prepared this book of case studies of the use of graphic instruments.

The book is more a volume of experience than it is of opinion. Its principal content consists of more than 250 case studies, each covering a distinct problem. These studies give the procedure followed, the graphic charts obtained and the solution reached. Throughout the entire book the authors have not only endeavored to impart information but to spur the reader to a continuous reappraisal of his methods and achievements.

The introductory section is divided into three chapters entitled The High Cost of Inefficiency; What Graphical Representation Means; and Classification of Industrial Problems. The remainder of the book is in five divisions: The Problems of Power; The Problems of Machines; The Problems of Processes; The Problems of Men; and Research and Special Problems. The case studies throughout the 19 chapters are numbered serially and are cross-indexed.

[*"Graphic Routes to Greater Profits," by John W. Esterline. Published by The Esterline-Angus Co., Indianapolis, Ind. Tooled fabricoid cover; 8½ x 11 in.; 320 pages; price, $3.*]

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Pape-Swift Boiler Book

The 1938 volume of the Pape-Swift Boiler Reference Book further supplements the specifications of boilers given in the four previous editions. The purpose of these books is to make available in one source boiler information such as boiler number, grate area, heating surface and manufacturer's rating. The information published in these books is furnished by the manufacturers and the five editions now list over 900 models of more than 80 different manufacturers.

The 1938 edition contains many line drawings and halftones showing such dimensions as height from grate to crown sheet, length and width of firebox, height from floor to grate, and grate dimension. All of these are highly important for proper installation of mechanically fired equipment. Available to each purchaser of this edition and of the combined editions is a master index which shows a complete listing of each manufacturer and model of boiler contained in the five editions of the boiler reference book. This index greatly simplifies the matter of locating any particular boiler.

[*"The Pape-Swift Boiler Reference Books." Published by John S. Swift Co., Inc., 105 S. 9th St., St. Louis, Mo. Paper cover; 5½ x 8¼ in.; 331 pages; price, $1. Extra copies of master index available at 25 cents.*]

Fire Codes for Flammable Liquids and Gases

This volume includes the 36 standards and regulations giving complete information on the safe handling of both flammable liquids and gases. The several codes are in the form of suggested ordinances, regulations, or recommended good practice requirements and are purely advisory as far as the National Fire Protection Association is concerned, but are widely used as a basis of law, or as a guide by administrative authorities in the exercise of their discretionary powers, as well as for insurance purposes. Prepared by technical committees including engineers representing all major interests concerned, they are accepted as the authoritative guides to the best practice in fire prevention and fire protection.

Typical examples of the 36 standards are: Flammable liquids ordinance; marine oil terminals; tank truck ordinance; oil burner regulations; kerosene or oil stoves; liquefied petroleum gas code (propane and butane); paint spraying and spray booths; city gas; gas systems for cutting and welding; and fire hazard properties of flammable liquids, gases, and volatile solids.

[*"National Fire Codes for Flammable Liquids and Gases, 1938," compiled by Robert S. Moulton. Published by National Fire Protection Association, Boston, Mass. 6 x 9 in.; 360 pages; price, $1.50 postpaid.*]

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Law for Engineers and Architects

As the author of this book points out, the work of the engineer and architect is no longer confined solely to designing and construction. Engineers have become in many cases counsellors and advisers in the investigation and promotion of enterprises and they are constantly being confronted with legal problems relating to these enterprises.

It is the purpose of this volume to state the fundamental principles of law in all branches which bear most directly upon the engineering profession and to illustrate these principles where space permits with cases. In this, the second edition of the book, the amount of explanatory text has been materially increased. The rules of law governing each particular subject are followed by amplified and explanatory material. Then follow such cases as are necessary to illustrate actually how the rules are applied.

A list of the main sections include: Law in General; Contracts; Agency; Mechanics' Liens; Negotiable Instruments; Sales; Property; and Workmen's Compensation. Also included is a list of standard forms of construction contracts, invitations to bid, subcontracts, contracts between owner and architect, and like material for purpose of reference and comparison.

[*"Law for Engineers and Architects," second edition, by L. P. Simpson and E. R. Dillavou. Published by West Publishing Co., St. Paul, Minn. Fabricoid cover; 6 x 9 in.; 629 pages; price, $4.50.*]

New Air Conditioning Manual by Trane

Of late years it has become quite the fashion for many of the major manufacturers of air conditioning equipment to assemble informational material into a manual. Usually the urge for a manual is brought on by the feeling that the field organization must have a compact mass of information in digested form readily at hand in order to apply the manufacturer's equipment to air conditioning jobs. These manuals are a part of the educational work which manufacturers have found it desirable to undertake in training their personnel.

This new Manual does not follow the general pattern. It is distinctly different from the others in conception and in breadth of treatment. Not only is the subject matter fully covered but it is discussed in an entirely dispassionate and factual fashion. It does not attempt to sell the user on the advantages of Trane equipment and methods over those of all others in the field.

The editorial arrangement is much more that of a straight text or reference book than can be said to be the case with other air conditioning manuals. The outline is clear-cut. The subdivision of the subject matter is logical and consistent. The style is particularly lucid, and the author drives straight to the point, rarely deviating to the right or to the left. The tone is not argumentative. Moreover the author writes with a clarity of expression rarely found in the presentation of technical material.

Perhaps the most outstanding material in a book which is really outstandingly good throughout, is that in the very excellent chapters 4 and 5, giving the properties of air, presenting a psychrometric chart, and illustrating and describing how calculations are made. The author has developed a distinctive chart using dry bulb temperature on an arithmetical scale plotted against dewpoint temperature. The resulting chart spreads the relative humidity lines wide apart on the more commonly used portion of the chart. The chart itself does not include scales showing quantities of heat or moisture content or volumes of air. However a unique celluloid ruler has been devised and a method is illustrated and described in detail in the book whereby these two, when used in combination, can be made to solve problems of a surprising variety.

The author has undoubtedly prepared the clearest and most exhaustive statement which has yet appeared showing how the calculations in air conditioning can be made with graphical assistance, and with a minimum of hand calculation.

The Manual as a whole is so thoroughly new, different, and so entirely worth while that it is difficult to see how anyone engaged in air conditioning can find reasons for not having it in his possession now that it is available.

Chapter headings are: Heat; Comfort; Heat Gains; Properties of Air and the Psychrometric Chart; Calculations for the Conditioned Air Supply; Refrigeration for Air Conditioning; Water for Air Conditioning.

[*"Trane Air Conditioning Manual," First Edition. Prepared under the direction of William Goodman. Published by The Trane Co., La Crosse, Wis. Stiff cloth cover, 8½ x 11 in., 333 pages; price, $5.*]

Gas-Fired Water Heaters

A report of an investigation of three types of water heaters. The three types tested were the external type tank, vertical flue type, and revertible flue type. Both the low input and quick recovery type heaters were included. The purpose of the investigation was to determine the operating characteristics and features of design of the heaters.

Test results showed that (1) an increase in water consumption resulted in an increased heater efficiency; (2) for a daily usage of 40 to 50 gal. hot water, the standby loss from the heater plays an important part in determining the overall efficiency; (3) the low demand water heater is slightly more efficient than the quick recovery heater; (4) the use of more effective insulation will increase thermal efficiency by reducing standby radiation losses; (5) the maximum rate of transfer has not been reached in the design of heating surfaces for water heaters; (6) there is a definite need for more sensitive snap-action thermostats which will maintain tank temperatures at as nearly a constant level as does the graduating type thermostat; and (7) in general, the best points for attention in improving gas-fired, storage heaters are the reduction of the heat content of the flue gases and the reduction of the standby loss.

[*"Automatic Gas Fired, Storage Type Water Heaters," by J. M. Krappe, Research Series No. 58. Published by Engineering Experiment Station, Purdue University, Lafayette, Ind. Cardboard cover; 6 x 9 in.; 72 pages; price, 25c. A limited number of bulletins are available without charge.*]

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Air Conditioning of Mines

Recently the Bureau of Mines made a study of literature on air conditioning of mines with particular reference to health, safety and efficiency. This circular presents Part 1 of the study. It deals with the physiological aspects of exposure to air contaminated by organic matter, noxious and toxic gases and dusts that emanate from various underground workings. The second part will discuss the relation of abnormal mine temperatures and humidities to the health and efficiency of miners, while Part 3 will describe theoretical and practical methods of air conditioning mines to correct or alleviate the conditions mentioned and will discuss the results obtained by some of the systems now in use in various parts of the world.

This circular opens with a discussion of the need for air conditioning in mines. The first chapter takes up the general foulness of underground air, while the second presents data on the gases encountered in mines. Chapter 3 takes up the subject of dusts and gives information on the prevention and treatment of dust diseases.

[*"Review of Literature on Conditioning Air for Advancement of Health and Safety in Mines," by D. Harrington and Sara J. Davenport. Information Circular 7001, Bureau of Mines, Washington, D. C. Paper cover; 8½ x 11 in., mimeographed; 38 pages; circular available from Bureau of Mines, Washington, D. C.*]

NEWS OF THE MONTH

Oil Tax, Gas and Coal Competition Carefully Considered at Oil Burner Institute Annual Meeting

CHICAGO—The 15th annual convention of Oil Burner Institute was held here April 11-12 at the Palmer House. In addition to the annual meeting, meetings of the executive committee, and board of directors were held. The associate groups also held their annual meeting during the two-day session while the dinner on the evening of the 11th provided a respite from the business activities embodied in the program.

At the manufacturers' conference, President F. H. Dewey acted as chairman and Frank E. Spencer, president of Burning Oil Distributors Association, acted as vice-chairman, discussed measures that should be taken to promote the public acceptance of oil as a fuel. Allan Reif addressed the meeting on steps to be taken to meet competition from other fuels. Milton A. Powers, as vice-chairman, aided Mr. Dewey in a discussion of the need for a study to determine methods of protecting the public in its selection of sound oil burning equipment.

A committee on sound burner standards was approved, selection of membership to be later announced by President Dewey. The duties of this committee will be broad but will be directed toward safeguarding of burner consumers interest.

The president advised the board of the Institute's activities in analysis of present day costs of standard burner equipment installed and properly serviced in each of the key markets throughout the United States. He asked the manufacturers to cooperate with the Institute through their dealers and distributors in the several markets involved.

At the annual dinner President Dewey, in welcoming the membership, stressed the need for solidarity in the industry and pointed out that problems went hand in hand with progress. He expressed his appreciation of the splendid cooperation given to him by the membership and urged each member to promote the Institute's activities in order that each might share in the success of its endeavor.

The annual dinner marked the inauguration of the Presidents' Dinner and was well attended by Chicago representatives of the oil and equipment industries. Frank E. Spencer was chairman of arrangements and Thomas Z. Hayward toastmaster. Speakers were Baird H. Markham, director of American Petroleum Industries Committee, whose subject was "Taxation of Fuel Oils." L. E. McGivena of New York chose as his subject "Great Days for Dumb Guys." President Dewey sounded a "Call To Arms" to all elements in the industry to get together for mutual advantage and to fulfill the industry's trusteeship to the public.

Mr. Dewey, of Gar Wood Industries, was the unanimous choice of the directors for president. Vice-presidents chosen were L. L. Jacobs, Electrol, Inc.; J. A. Lattner, Century Engineering Corp.; A. F. Reif, Reif-Rexoil, Inc.; F. H. Van Blarcom, Lynn Products Company; and J. H. Van Sciver, Bethlehem Foundry & Machine Co.

G. Harvey Porter was re-elected managing director and C. F. Curtin assistant secretary.

The Associates group elected E. N. McDonnell of McDonnell & Miller as chairman and J. W. Owens of Mercoid as secretary.

Standard Coal Classification Urged

WASHINGTON—A proposal made in the interest of consumers for a standard plan for the classification of coals, simple and practicable, to speed price establishment, has been submitted by John Carson, Consumers' Counsel, to the National Bituminous Coal Commission.

In a memorandum accompanying the proposal, Mr. Carson points out that the Office of Consumers' Counsel is committed to the standards prepared by the committee on coal and coke for the American Society for Testing Materials.

"We are satisfied," Mr. Carson declares, "that their eventual adoption will prove of benefit to the producers of bituminous coal, and certainly the consumers of bituminous coal are entitled to definite and understandable standards to protect them in their purchase of coal. We appreciate, however, that the first objective is to get fair and valid minimum prices established as quickly as possible and that the rather simple standards we suggest herewith may well be a first step which can be taken without loss of valuable time. The sounder step proposed in the ASTM standards can then be taken later, as can other steps to improve the administrative machinery. We have realized always that to expect the Commission to accomplish the ideal at once would be to expect too much, but I know you are entirely with us in our conviction that we should have the ideal as our goal and strive toward it step by step in a practical manner. That is what we are attempting in this proposal."

Copies of the full proposal may be obtained by writing to John Carson, Consumers' Counsel, Tower Building, Washington, D. C.

Gas Appliance Makers to Convene at White Sulphur in May

NEW YORK—The important part the Association of Gas Appliance and Equipment Manufacturers is playing in the life and growth of the gas industry and the rapid strides which are being taken in attaining its objectives will be reviewed at the Association's annual convention, to be held at White Sulphur Springs, W. Va., May 25-27.

One of the progressive features of this year's convention will be the emphasis that will be placed on individual divisional meetings. At these smaller gatherings problems which vary within the various divisions and which are characteristic of specific appliances will be handled individually.

Among the various divisions and their chairmen are: Gas Water Heater—A. P. Brill, president, Ruud Manufacturing Co., Pittsburgh, Pa.; Direct Heating Equipment—R. F. Cleary, secretary, Homestead Heater Co., Newark, N. J.; Gas House-heating and Air-conditioning Equipment—H. P. Mueller, president, L. J. Mueller Furnace Co., Milwaukee, Wis.; Gas Boiler Group—R. L. Clewell, of National Radiator Corp., Montclair, N. J.; Gas Furnace Group—C. B. Phillips, vice-president and sales manager, Surface Combustion Corp., Toledo, Ohio. Conversion Burner Group—H. L. Whitelaw, vice-president, American Gas Products Corp., New York; Thermostatic Control and Accessories—John A. Robertshaw, vice-president, Robertshaw Thermostat Co., Youngwood, Pa.

A.C. Council Conducts Campaign

BUFFALO—The Air Conditioning Council of Western New York, located in the Electric Building here, is conducting an advertising campaign suggesting to air conditioning prospects that they consult the Council. The advertisement points that the Council's staff can tell whether an air conditioning system proposed for a store, office or home is correct in design and adequate for the prospect's needs. The Council is also issuing a free booklet entitled "How to Buy Air Conditioning."

Schedule Boston-Chicago A.C. Train

BOSTON—A new regular fare through train from Boston to Chicago will be inaugurated June 15 by the Boston & Albany. It will consist of all air conditioned equipment, including roomette bedroom, compartment and drawing room cars, a full-length lounge car, buffet lounge car and a diner—eight cars in all. The present Boston section of the Twentieth Century Limited will be discontinued.

Successful Warm Air Meeting Held at Michigan State College

EAST LANSING—One hundred and sixty-two persons from 11 states and Canada attended the 7th annual Forced Warm Air Conference at Michigan State College here March 28-31. The course was practical from beginning to end and stressed the actual design calculations and layout of systems.

The method of procedure was to supply each group with a set of plans and a calculation sheet. The various groups then proceeded to calculate in detail and to the finest degree the heat loss (in the heating groups) and the heat gain (in the cooling group), receiving lectures throughout as to the reasons for the various calculations. All calculations were logically arranged and worked out until the final heat loss or heat gain of the building was calculated.

The next step was the layout and design of the ductwork which was also carefully done, taking into consideration friction loss, or the equivalent length of ducts, and temperature drop through the actual length of ducts, making corrections in sizing the ducts and in c.f.m. requirements as required. The layout was then drawn upon the plans showing all supplies, returns, and sizes giving consideration to air distribution as well as air supply.

President R. S. Shaw made the address of welcome on Monday noon. Then those in attendance were divided into three major groups: The elementary heating class was under the direction of B. F. McClouth; the advanced course was directed by Fred Bishop, with Gilbert Denges and Frank Myer assisting; Walter G. Schlichting conducted the cooling class. General lectures were given for the entire group periodically.

Among the subjects introduced on the program were the following: Seasonal Heat Loss, G. C. Alder; Soil Temperature and Heat Loss Below Grade, C. M. Pesterfield; Recent Developments of Air Cleaning, H. C. Murphy; Dehumidification By Absorption, D. F. Cushing; The Humidity and Insulation Problem, L. G. Miller; a sound film and lecture showing the manufacture of steel and its uses in the industry, T. I. Byrd; Automatic Controls for Residences, C. W. Nessell; Selection of Heating and Cooling Coil, A. S. Ammerman; Fan Selection, S. H. Downs; Air Distribution, Robert L. Leigh; merchandising talks by Frank Mehrings and Dan Schmidin; Combustion, Dean H. B. Dirks.

The banquet held Wednesday night was a joint meeting of the ASHVE Michigan chapter. L. R. Taylor gave a talk on the history of the warm air heating industry, and Prof. J. D. Hoffman, Purdue University, chairman of the code committee, gave a résumé of the activities of that committee.

Alabama Poly Develops New Fuel

BIRMINGHAM, ALA.—Dr. C. A. Basore told the Alabama Academy of Science recently a new method of transforming low-grade lignite into "an efficient and almost smokeless fuel," had been developed at Alabama Polytechnic Institute at Auburn.

Lignite is found in large quantities in Alabama, and Doctor Basore, assigned to the engineering experiment station at Auburn, said development of a cheap fuel in South Alabama would facilitate the industrial development of that section of the state.

Doctor Basore's new method, upon which he has been working for several years, involves the destructive distillation of the lignite at low temperatures and the compression of the residue—without the use of a binder—into small discs or briquettes weighing from one to three ounces.

The finished briquette, in many respects, is decidedly superior to the raw lignite and apparently is suitable for either domestic or an industrial fuel, Doctor Basore believes.

Based on figures from the U. S. Bureau of Mines, cost of producing the briquettes is estimated at $3 per ton. Cost of the raw lignite was estimated at $1.84 per ton and the production costs of briquetting at $1.33 for each ton.

Apt Describes A.C. at World's Fair

NEW YORK—Howard G. Meinke, Consolidated Edison Company of New York, Inc., was elected president of the ASHVE New York chapter for the coming year at the chapter's April 18 meeting. O. O. Oaks was elected vice-president while T. W. Reynolds remains secretary and S. M. Heebner remains treasurer.

The speaker of the evening was S. R. Apt, mechanical engineer for the New York World's Fair, who told his audience about the air conditioning being installed in the various buildings at the Fair and particularly explained the cooling installation which is to be installed in the sphere.

The sound motion picture, "Romance of Iron and Steel," made by the American Rolling Mill Company, was shown by R. A. Balazs of the company's New York office. The film described the new rolling process Armco has developed for making sheets.

Royal York Completes A.C. Plant

TORONTO, ONT.—The Royal York Hotel, the largest in the British Empire, has just completed the installation of a year-round system of air conditioning in the public spaces, convention halls, and dining rooms throughout the hotel. The equipment will have a capacity of supplying 335,000 c.f.m. of conditioned air.

Thermostat is Located in Brain, Controls Body Heat Output

PITTSBURGH—The heat generated by the human body is automatically controlled by an electric thermostat in the brain, declared Dr. H. W. Magoun of Northwestern University Medical School at a session of the American Association of Anatomists here on April 16. This thermostat, located near the center of the brain, was discovered by stimulating the brain with high-frequency of radio waves on various regions of the skull. In this way it was possible to cause cats and human beings to sweat under cold conditions, or shiver in a heated room.

Apparently this thermostat works just as do those which control heating devices, that is, the arms and legs first give off the nerve impulses indicating heat or cold. These nerve impulses, acting just as an electric current, apparently are received by the brain thermostat and cause it to stimulate the bodily processes to generate more heat to keep a person warm in the winter, or to perspire in the summer to keep a person cool.

Perspiring is the only way in which the body can keep cool during heat conditions, and shivering, the first sign of cold conditions, is the first attempt of the body to generate heat by exercise. Both are apparently under control of the brain thermostat, which responds quickly to a change of only a few degrees in the temperature outside the body.

Purinton Speaks to Toronto Group

TORONTO, ONT.—The regular April meeting of the Ontario chapter, ASHVE, was held in the Royal York Hotel with an attendance of 68.

The speaker of the evening, Dexter J. Purinton, New York, gave an address on "Radiant Heating." There was considerable discussion. E. R. Gauley introduced the speaker and Prof. E. A. Allcutt extended a vote of thanks.

Following the dinner, Harry Angus made a report on the good progress the Code Committee is making.

Boston Reports First Quarter A.C.

BOSTON—A total of 256¾ hp. has been added to the connected load of Boston Edison for air conditioning in the first three months of 1938 to April 20. Sales progressively increased from only one in January, the new Waldorf Restaurant at Framingham, to ten in March and three in the first twenty days of April. Quite a number of others, however, are on the point of closing. The largest single installation was 80 hp. additional by the S. S. Kresge store and the next largest a 70-hp. job by the Paramount Picture Distributing Company for its office.

ASHVE to Study Radiant Heating, Solid Fuel Burning Test Methods

NEW YORK—Under a new technical advisory committee set up by the committee on research of the ASHVE, a coordinated study of the effects of radiant heat on human comfort and its economic value as compared to convected heat, will be undertaken on a broad scale, according to W. L. Fleisher, chairman of the society's general research committee.

The new committee, headed by J. C. Fitts, executive secretary of the Heating, Piping and Air Conditioning Contractors' National Association, proposes to assemble and coordinate existing data with a view to defining more easily the physiological aspects of supplying more or less heat to the body by direct radiation and to determine the degree and range of comfort experienced by persons subject to radiant heat. The committee will also be concerned with interpreting research laboratory data resulting from studies made at Yale under Prof. C.-E. A. Winslow and at the University of Cincinnati under Dr. C. A. Mills and others.

In addition, a new technical advisory committee for the coordination of research on solid fuels and the development of standardized test methods and performance specifications for heating equipment has been announced by the Society. Lt. Col. W. A. Danielson has accepted the chairmanship of this new committee which marks the re-entrance of the society into a form of heating research which has lain dormant for a number of years.

Carter Addresses ASME Juniors

NEW YORK—The Junior Seminar group on air conditioning of the metropolitan section of ASME listened to B. F. Carter, commercial engineer, air conditioning department, General Electric Company, at its monthly meeting here April 19. Mr. Carter used for his subject "Residential Air Conditioning" and during the course of his presentation he described systems, methods and equipment now available for heating and cooling residences. The paper prompted a lively discussion conducted in the seminar fashion by Chairman S. Davidson of the Armo Cooling and Ventilating Company, Inc.

Canadian Road Adds 120 A.C. Cars

MONTREAL, QUE.—By the end of 1938, the Canadian National Railways will have 315 air conditioned sleeping and dining and parlor cars, according to W. W. Swinden, general superintendent of the passenger car department. This year 120 air conditioned cars will be added to the 195 now in use. Many of the older cars will be rebuilt and equipped with air conditioning equipment.

Konzo Speaks on Furnace Heating at Chicago ASHVE Meeting

CHICAGO—Prof. S. Konzo, of the University of Illinois, was the speaker at the April meeting of the ASHVE Illinois Chapter, held April 11. Professor Konzo's subject was "Trends in Forced Air Heating." He stressed the fact that tests have indicated that: Fuel consumptions were decreased with a given furnace installation when the rate of oil input was decreased; fuel consumption for a furnace designed to burn oil (having 100 sq. ft. of heating surface) was materially less than that for a conversion furnace (having 70 sq. ft. of heating surface); although the maintenance of relatively high percentages of CO_2 in the flue gas is advisable, the most effective means of providing for minimum oil consumption is to operate with low flue gas temperatures; the comfort conditions in the room were improved, particularly during zero weather, with more nearly continuous operation of the fan, such as can be provided by a two-volume delivery fan; very marked improvements in the floor temperature were obtained by converting the plain perforated grille type baseboard register to the deflecting type baseboard register; and the extremely rapid developments and refinements in the field have led towards compact units that are economical in operation and that provide for optimum comfort under all conditions of service.

Seid Addresses Boston A.C. Bureau

BOSTON—A special meeting of the Air Conditioning Bureau was held April 13 at the Hotel Statler, in conjunction with the New England Building Officials' Conference. The guest speaker was Herman Seid of the Auditorium Conditioning Corporation, who spoke on "The Evolution of Air Conditioning."

Participating groups included the Boston Society of Architects, Engineering Societies of New England, Inc., Producers' Council Club of Boston, Associated General Contractors of Massachusetts, the Master Builders' Association and the Boston Real Estate Exchange. There were exhibits of materials and new methods of construction by various manufacturers.

Subjects discussed at the conference were: "Our National Slum Clearance and Low Rent Housing Program as initiated by the United States Housing Act of 1937," by Ernest M. Culligan, U. S. Housing Authority, Washington, D. C.; "New Building Codes and Their Relation to Cost of Construction," by Howard P. Vermilya, director of the FHA technical division, Washington; "Problems of the Contractor," by E. J. Harding, managing director, Associated General Contractors of America.

Detroit A.C. Contractors Organize; Will Aid Prospective Buyers

DETROIT—The Air Conditioning Association of Michigan was organized here recently as the culmination of several informal meetings attended by representatives of contractors engaged in year-round air conditioning.

The purpose of the association will be to protect the purchaser of air conditioning equipment by fostering the sale of true air conditioning systems; to encourage fair trade practices among the members; to assist in the formation of a suitable air conditioning code for Detroit; to establish better relations between the public and the industry; and to exchange information with contractors' associations in other cities.

Officers elected by the group at the organization meeting were: R. C. Doremus, Detroit Ice Machine Co., chairman; C. H. Lewis, R. L. Spitzley Co., president; Harry Heberlee, Heberlee Ice Machine Co., vice president; H. C. LeVine, Atmospheric Control Corp., secretary and treasurer.

Committee chairmen elected were: membership and by-laws, H. B. Orr, Airtemp Construction Corp.; fair trade practice, R. H. Gordon, American Refrigerating Co.; city code, Louis S. Morse, Jr., Westerlin & Campbell; public relations, J. H. Keller, Mechanical Heat and Cold Inc.; F. T. Schreiner, Detroit Kelvinator Branch.

The group voted to adopt the use of an official analysis form to be submitted to the prospective owner of an air conditioning system with the formal proposals he receives. This form will assist the owner in making a fair and impartial analysis of bids received, by enabling him to ascertain exactly what each contractor agrees to supply.

Stoker Builders to Meet in South

CHICAGO—At the regular quarterly meeting of the Stoker Manufacturers Association held here on April 8, it was decided to hold the annual meeting of the Association at Hot Springs, Va., June 16-17.

A convention committee was appointed by President R. C. Goddard to prepare a program of speakers and subjects for discussion. The following members of the association were appointed to this committee: J. E. Martin, chairman, Link-Belt Company; Stevens H. Hammond, Whiting Corporation; J. M. McClintock, Illinois Iron & Bolt Company.

As has been the custom during the past two years the second day of the Association's meeting will be an open forum in which members of the coal industry will be invited to participate and discuss problems of mutual interest. The first day's session will be devoted to subjects directly affecting stoker manufacturers.

ANSWER TO THIS MONTH'S PROBLEM

The solution to the problem on page 58 follows:

Since the engineer's wife arrives home thirty minutes earlier, this means she saved that much time in the round trip, or fifteen minutes saved on the journey down and fifteen minutes coming back. If this is so, then she must have met her husband fifteen minutes before she would have arrived at the station, and since the engineer was at the station sixty minutes early, but met his wife only fifteen minutes early, he must have walked for forty-five minutes.

Babson Sees Great Future in A.C.

BOSTON—Roger W. Babson, the noted statistician and head of the Babson Statistical Organization, stated in a recent issue of the *Boston Transcript:* "Fighting over what now exists instead of trying to produce more is our first big mistake. Trying to revive old industries is our second big mistake. During the past three months I have devoted a large amount of time to an impartial study of various new industries on the horizon. I feel that air conditioning offers the greatest opportunity."

Mr. Babson said that if the same amount of energy spent on political back-biting were spent on whipping up enthusiasm over air conditioning, five million people would be returned to jobs.

"Most of the new industries would put out of work some people who are now engaged in existing occupations. This is not true of air conditioning. It could directly or indirectly give millions of people jobs and go a long way toward restoring employment to normal conditions."

Warm Air Group to Meet June 13-15

COLUMBUS—The summer meeting of the National Warm Air Heating and Air Conditioning Association, which is to be held in the Plankinton Hotel, Milwaukee, June 13-15, promises to be another important event in the industry. The program is practically complete and has been formulated with particular reference to topics of interest to dealers and jobbers, as well as manufacturers and engineers.

Entertainment features include an unusual party on Tuesday evening, and a golf tournament on Wednesday afternoon. All of the sessions will be open to non-members as well as members.

Formal announcement and program for this convention will be issued the latter part of May.

Iowa State Sponsors Conference

AMES, IOWA—Heating and air conditioning contractors, stoker dealers and coal merchants attended the Third Heating and Air Conditioning Conference held here April 6-8. Many types of air conditioning equipment were exhibited in connection with the Conference.

Among the subjects discussed were the operation of small stokers, stoker coals, installation of forced warm air heating systems, methods of making heating surface installation, controls, air distribution, moisture accumulation within walls and sound insulation. A dinner-meeting on Friday night closed the conference.

L. J. Murphy of the Engineering Extension Service of Iowa State College was in charge of the Conference and was assisted by various members of the faculty and extension service.

Expert Predicts a Hot, Dry Summer

BOSTON—E. B. Rideout, famous meteorologist of radio station WEEI, whose daily weather broadcasts have become a New England institution, predicts that the coming summer will be a "scorcher." Hot and dry weather will reach drought proportions for the entire country. For New England he predicts temperatures above normal almost continuously from the latter part of June through the first part of August, with a serious deficiency in rainfall. Usual spring weather is predicted through May. A breaking down of the heat will occur in the last days of August, but dry weather and drought will continue, however, through the month.

Mr. Rideout's forecasts for the winter and summer of 1937 were highly accurate.

Carrier Unveils New A.C. Units

SYRACUSE, N. Y.—A new development in self-contained water-cooled air conditioning units was announced here April 8 by L. R. Boulware, vice president and general manager of Carrier Corporation, who unveiled the units before 25 business paper editors.

The units, which come in two sizes rated at three and five tons, respectively (1100 c.f.m. and 1460 c.f.m.) are suitable for stores, shops and offices. They are said to cut costs one-third for installed equipment of the same air conditioning capacity.

The unveiling included a dramatization of the cooling effect given off by the units. Colored lights played on pyramided cakes of ice placed in the rear of the air conditioners. Sixty 100-lb. blocks of ice were behind the three-ton cabinet, and a hundred 100-lb. blocks in the rear of the five-ton.

ANSWERS TO QUESTIONS ON PAGE 58

1. Round boilers are commonly sized at the grates, furnaces at the top of the firepot. A 24-in. furnace, therefore, has a grate less than 24 in. in diameter. (3) is correct.

2. A micron is a thousandth of a millimeter or a millionth of a meter. It is a linear measure used frequently in air conditioning in connection with dust particle sizes. Thus (2) is the right answer.

3. Louvre is an old French palace now used as museum and art gallery, so that (3) is correct. The shuttered window used in ventilating is a louver.

4. Adiabatic denotes changes in volume or pressure with no transfer of heat to or from the outside. (3) is correct.

5. Resistivity is the reciprocal of conductivity so that (3) is the right answer.

Evans Heads Steamfitting Concern

CHICAGO—Howard W. Evans has formed a new steamfitting contracting organization named Piping Contractors, Inc., of which he is president. The organization will be located at 506 S. Wabash Ave., Suite 704.

D. E. McCabe

CHICAGO—D. E. McCabe, former Chicago branch manager of the International Heater Co., Utica, N. Y., died at his home in Toluca, Ill., March 24. He was 73 years old and at the time of his death was retired. Mr. McCabe was associated with International Heater for 29 years when he retired in 1928. He is survived by his widow.

Edward Lenz

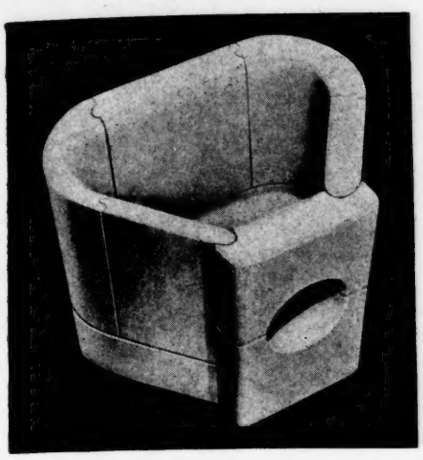
NEW YORK—Edward Lenz, manager of distribution operation, New York Steam Corporation, died March 18 after an illness of five months. Associated with New York Steam since 1912, Mr. Lenz in 1924 was made general superintendent of distribution and in 1936 manager of distribution operation.

Edward Lenz

Active in the National District Heating Association, Mr. Lenz served on the distribution committee, as member of the executive committee, and currently as third vice-president.

He is survived by his wife and two daughters.

NEW EQUIPMENT

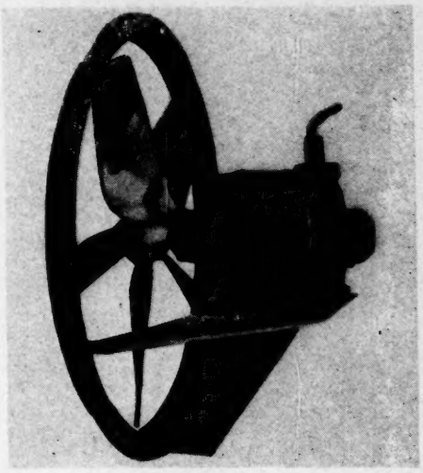


Babcock & Wilcox Combustion Chamber

NAME — Babcock & Wilcox precast combustion chamber.
PURPOSE—For use with oil burners.
FEATURES — These chambers are made in accordance with the oil burner manufacturer's own design for his specific requirements. A complete set of shapes for one chamber is usually packed in one container and includes 10 lb. of B&W air-set mortar (dry) for pointing up or cementing joints. The manufacturer claims that the chamber is light weight, has a high insulating value and low heat storage capacity. It is said that the chamber makes possible a high oil burner efficiency. The manufacturer states that it is easy to install, being made up of tongued and grooved pieces which pass through the fire or ash door with a minimum of time and labor.
MADE BY—*The Babcock & Wilcox Co., Refractories Div., 19 Rector St., New York.* *1*

Sterling Trap

NAME AND MODEL NUMBER — Float and thermostatic trap, No. 69.
PURPOSE—A small float and thermostatic trap for handling the condensation of unit heaters, unit ventilators, mains or risers, or small blast coils.
FEATURES—Trap is said to be unusually compact and is supplied with two inlet tappings and two outlet tappings, making four different connections possible. Seat and valve cone are made of stainless steel. As all piping connections enter the cover which carries the bellows type thermostatic members, the body can be removed for cleaning by removing four head screws.
SIZES AND CAPACITIES — One size with capacity 200 lb. of water per hr.
LITERATURE AVAILABLE—Bulletin No. 69.
MADE BY—*Sterling Engineering Co., 3738 N. Holton St., Milwaukee.* *2*

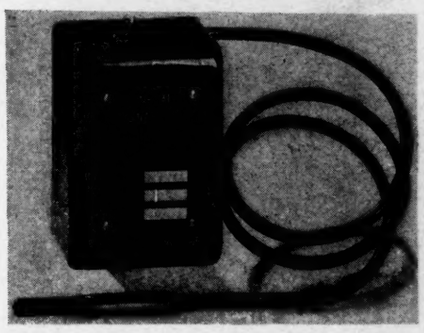


Binks Exhaust Fan

NAME AND MODEL NUMBER — Binks W F D exhaust fans.
PURPOSE—Ventilating fans for stores, factories, and similar plants.
FEATURES—Fans are furnished with a guard over a five-bladed propeller. They are said to be easily put in place in the window, transom, or other opening by mounting a wood or metal frame around the fan. Explosion-proof motors are available in various common specifications. These fans are not recommended where quiet operation is required.
SIZES—Sizes from 18 to 34 in.
MADE BY—*Binks Manufacturing Co., 3114-40 Carroll Ave., Chicago.* *3*

General Thermocouple Pilot

NAME—Thermopilot.
PURPOSE—For automatically closing gas valves when the gas pilot fails.
FEATURES—This control utilizes the thermocouple principle of operation. When the flame is applied to the thermocouple element, contact is made, allowing the main gas valve to open. Should the pilot light fail, the Thermopilot automatically opens the circuit and the gas valve closes. When the pilot is relighted the device automatically resets itself. Available with either two- or three-wire controls.
MADE BY—*General Controls Co., 450 E. Ohio St., Chicago, Ill.*.....*4*



TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below circle the item number of the equipment in which you are interested, using the identifying number found at the end of each description

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

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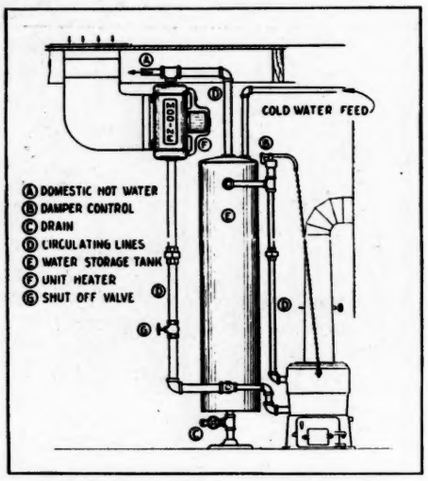
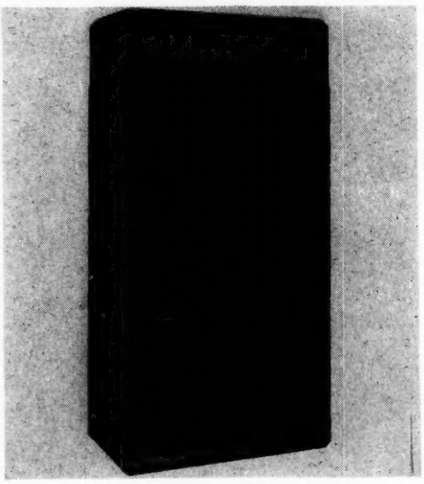


Modine Supplementary Unit Heating System

NAME—Modine system of supplementary house heating.
PURPOSE—For supplementing the operation of the house heating system during spring and fall days or during cold weather.
FEATURES—Briefly, this system consists of a hot water type Modine unit heater connected by a short supply duct to the room to be heated. The unit heater is supplied with hot water from a domestic hot water storage tank which obtains its hot water from a bucket-a-day type tank heater. The fan of the unit heater forces air through the heating element, resulting in a high rate of heat transfer from the hot water to the air. The warm air is delivered from the unit through the supply duct into the area to be heated. Operation of the unit heater may be controlled manually or thermostatically.
SIZES AND CAPACITIES — Seven sizes with free air delivery capacities ranging from 7,500 to 81,000 B.t.u. per hr. and 1/8 in. static resistance capacities ranging from 12,780 to 47,800 B.t.u. per hr. Above capacities obtained with 145F water.
LITERATURE AVAILABLE—Anthracite Industries Laboratory Bulletin No. 33.
MADE BY—*Modine Manufacturing Co., Racine, Wis.* 5

Delco-Frigidaire Air Conditioning Unit

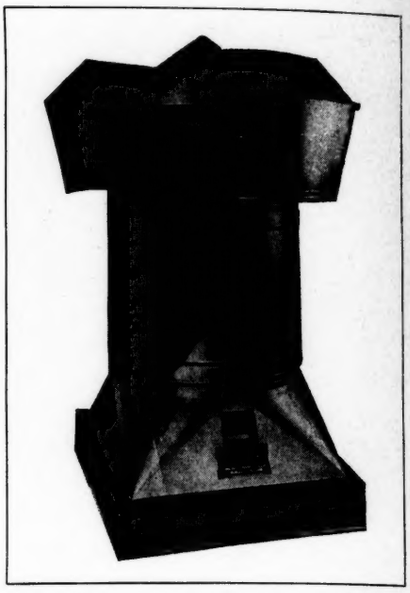
NAME—Three-ton Delco-Frigidaire air conditioner.
PURPOSE—For summer or year-round conditioning of retail establishments and other commercial applications.
FEATURES—The unit provides cooling, dehumidification, filtering and air circulation. A heating coil may be added as optional equipment to provide year-round utility. Unit is entirely self-contained, requiring only power, water and drain connections. It is said that the unit can be removed and reinstalled at a new location as a unit with full salvage value. Conditioned air is delivered from an acoustically insulated distribution hood at the top of the unit. Outlet is equipped with directional flow grilles to permit distribution of air to fit the requirements of the particular insulation. Where desired, the outlet flow may be omitted and the conditioner connected direct to the duct. Thermostatic control is provided as standard equipment. A 3-hp. water-cooled condensing unit is located in the lower section of the cabinet and the entire unit is isolated from the cabinet by means of a flexible rubber mounting. The compressor compartment is lined with a blanket of acoustic and heat insulating material. Heat generated within the compartment during operation is removed by a finned water coil, air circulation is within the compartment, being furnished by a fan built into the compressor flywheel. The upper section of the cabinet contains the filters, evaporator coil and fan. Freon is the refrigerant.



CAPACITY—Three tons.
MADE BY—*Delco-Frigidaire Conditioning Div., General Motors Sales Corp., Dayton, Ohio.* 6

Harnischfeger Arc Welder

NAME—P&H-Hansen arc welder, 150 ampere, vertical type.
PURPOSE—For welding lighter gage metals, both ferrous and non-ferrous.
FEATURES—Unit is designed to occupy a minimum of floor space and is equipped with plug-in type cable receptacles for easy current reversing, and patented, single-current control. Furnished in the a.c. drive only. A towing handle provides for easy movement while stability is obtained when raised to form a 3-point base. Unit can also be furnished with a lifting ring and without wheels where portability is not necessary.
MADE BY—*Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.*...7



DeBothezat Fan Roof Ventilator

NAME—DeBothezat fan roof ventilator.
PURPOSE—To provide ventilation under all atmospheric conditions.
FEATURES—This ventilator has been developed to meet the increasing demand for a positive ventilator. The fan used is a standard DeBothezat Type L with the non-overloading power characteristic. Motor is totally enclosed with ball bearings and is designed especially for vertical operation. Fan ring and motor are mounted on vibration dampeners to eliminate noise and vibration.
SIZES—Sizes range from 14 to 48 in. fan diameter.
LITERATURE AVAILABLE — Fan Roof Ventilator Bulletin DRV-B.
MADE BY — *DeBothezat Ventilating Equipment Division, American Machine and Metals, Inc., 100 Sixth Ave., New York.* 8

Harnischfeger Packaged Welding Electrodes

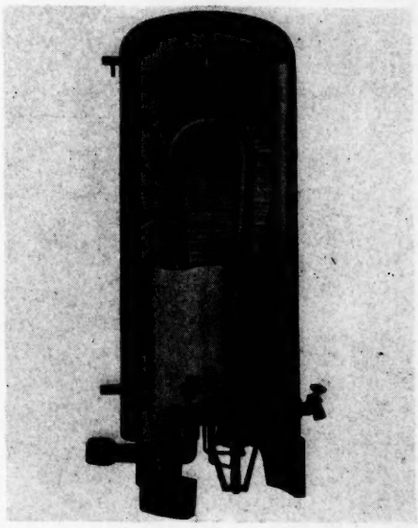
NAME—Harnischfeger packaged Smootharc welding electrodes.
PURPOSE—Packaged welding electrodes to provide fresh electrodes at all times.
FEATURES—The manufacturer states that the sodium silicate which is present in all types of welding electrodes will absorb moisture from the air, causing the silicate to lose its adhesive qualities and cause spalling. This company now packs their welding electrodes in a hermetically sealed metal container so as to keep the electrodes in perfect condition. Containers are opened with a key attached to one end. Size and type of electrode is marked on each so that the type desired can be quickly found.
MADE BY—*Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.* ..9

Wagner Evaporative Type Cooling Fans

NAME—Wagner evaporative cooling fan assemblies.
PURPOSE—These fan assemblies are designed for use in evaporative cooling devices such as are used in the southwest United States for air cooling.
FEATURES — During the past few years a large number of buildings in southwestern United States have been cooled with evaporative type coolers. The method of construction consists of a windowbox with an excelsior or fiber mat placed in a vertical position with provision at the top for dripping water through the excelsior or fiber pad. Cooling is produced by drawing large volumes of air over the moist mat, thus providing active circulation of cool air through the building. These fan assemblies are designed especially for use with this type of device. The fan blades are of the slow speed exhaust type delivering large volumes of air with a minimum of noise. Motors available are provided with either one end enclosed or totally enclosed to prevent the entrance of dust and moisture.
SIZES AND CAPACITIES—Available in six sizes with capacities ranging from 1550 to 4000 c.f.m. Motors available in either 110 or 220 volts, 25 or 60 cycle, single or three-speed type.
LITERATURE AVAILABLE—Bulletin 185.
MADE BY — *Wagner Electric Corp., 6400 Plymouth Ave., St. Louis.* *10*

Janitrol Water Heaters

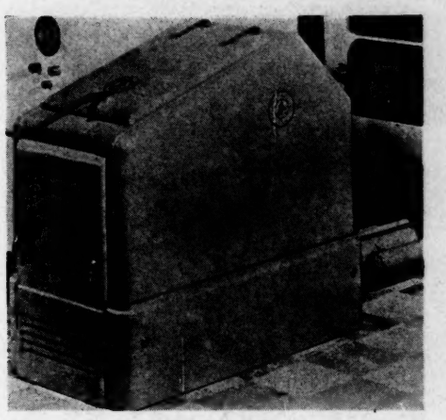
NAME—Janitrol thrift water heaters.
PURPOSE — For supplying domestic hot water using gas as a fuel.
FEATURES — The gas input to this heater can be set in accordance with the individual user's hot water requirements. This, the manufacturer claims, establishes in advance the monthly gas bill for water heating, assuring hot water service at a budgeted cost which cannot be exceeded. Three of the principal features of the heater which are said to give efficient operation are: (1) effective heating by passing the heat slowly through the water. This is accomplished by a long inverted U-shaped heating element within the tank through which pass the hot gases from the burner; (2) a small burner located in one end of the heating tube and regulated to burn just enough gas to replenish the hot water supply only as fast as it is normally consumed; (3) a large capacity, heavily insulated, hot water storage tank. The same burner is used on all models and is supplied by the manufacturer with any specified input from 3500 to 10,000 B.t.u. per hr. If it is desired to set the input on the job, the burner orifice comes drilled for 10,000 B.t.u. input and the exact desired input is then set by thermostatic adjustment when the heater is installed.



When a gas pressure regulator is used the burner is available with 12,500 B.t.u. per hr. input.
SIZES AND CAPACITIES—Three sizes with storage capacities of 30, 45, and 60 gal.
MADE BY—*Surface Combustion Corp., Toledo, Ohio.* *11*

Iron Fireman Stoker

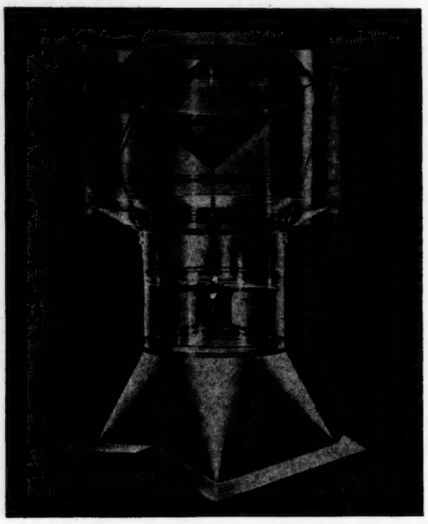
NAME—Iron Fireman "DeLuxe Heatmaker" stoker.
PURPOSE—For firing domestic and small commercial furnaces and boilers.
FEATURES—The standard hopper of the new stoker holds 500 lb. of coal. Feed worm, agitators and slope of the hopper bottom have been redesigned to improve coal feeding ability. Low torque agitators are said to require less power than formerly. A hopper bottom cleanout has been added. A spike grabber guide and wear plate is placed in the worm housing end of the hopper bottom. Thickness of the hopper lid has been doubled, and a combined coal baffle and hopper lid stop added. New hopper base enclosures, and a lift-away



door, completely expose the operating mechanism when removed.
CAPACITIES—From 30 to 150 lb. of coal an hour.
MADE BY—*Iron Fireman Mfg. Co., Portland, Oreg.* *12*

Wagner Motor

NAME AND MODEL NUMBER — Polyphase motor, type RT.
PURPOSE—A large size electric motor designed to provide comparatively low starting current, high starting torque, satisfactory working characteristics, and good speed regulation.
FEATURES—There are several localities where double squirrel cage motors of the larger sizes would produce undesirable voltage variations and it is desirable to have a motor available which meets rigid starting current requirements. This motor was developed for such installations. It has a locked torque of about twice full load torque and a locked current of from three to three and one-half times full load current. If the motor should become accidently locked, a thermal device operates and breaks the circuit leading to the holding coil of the primary magnetic contactor and thus disconnects the motor from the line. This thermal device operates in the same way in case the low resistance winding should become accidentally open-circuited. This circuit does not have a centrifugal switch but is controlled by a magnetic starter which contains two contactors. One of these is the line switch which closes immediately when the button is pushed or when the automatic control is energized. The second contactor short-circuits the low resistance winding after a definite lapse of time and may be adjusted to suit the time required to accelerate the load.
SIZES AND CAPACITIES—Available in a large variety of ratings but will ordinarily be built only in sizes 40 hp. and larger because in most localities the use of a double squirrel cage motor of 30 hp. ratings and smaller is approved by the power company.
MADE BY — *Wagner Electric Corp., 6400 Plymouth Ave., St. Louis.* *13*

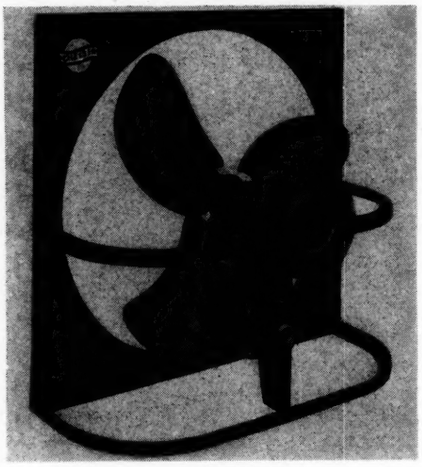


Burt Fan Ventilator

NAME—Burt Free-Flow fan ventilator.
PURPOSE—A fan type roof ventilator.
FEATURES—These ventilators are constructed of three parts, the base, head and fan barrel. Base and head are the same as supplied in the gravity unit with the exception of additional stiffening in the bases of the larger sizes to support the added weight of the fan assembly. The fan barrel consists of a section of round airshafting of sufficient length to house the motor mounting, motor and fan. Three types of ventilators are offered, one for ordinary ventilating problems where no adverse conditions are existent and the primary requisite is a high movement of air; the second for handling air at temperatures higher than electric motors are constructed to withstand; and the third for moving air containing fumes which are destructive to electric motors and metal parts. In the heat resisting type the motor is rigidly fastened in a sheet steel shell properly proportioned to allow an annular air passage between motor and shell. The action of the ventilator fan draws outside air through the support arms, upward between the motor and shell, discharging it into the main air stream at the top of the motor. By using these air intakes, a supply of cool outside air is obtained, independent of the main exhaust stream, which allows the ventilator to be used in temperatures much higher than would otherwise be possible. Heat resisting construction is available in any of the standard materials, including asbestos protected steel. The acid-resisting type is similar in design to the heat resisting type with two exceptions. A circular plate is fastened over the upper end of the motor between motor and fan, its outside edge extending just beyond the motor housing shell to prevent condensation from draining into the motor shell. The entire shell and support arms, both inside and outside, the motor, its shaft and fan wheel are heavily coated with acid-resistant asphaltic compound.
SIZES—Sizes range from 12 in. to 96 in.
MADE BY—*The Burt Manufacturing Co., Akron, Ohio.* *14*

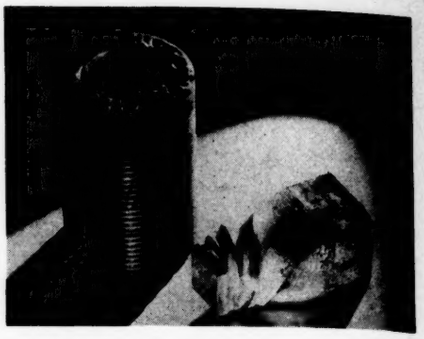
Chelsea Attic Fan

NAME—Chelsea attic fan.
PURPOSE—For cooling using night air.
FEATURES—Fan is constructed with a frame of welded steel and is designed so that it may be easily installed in walls or penthouses. It may also be used as a portable floor fan. Propeller is of three blade type designed to deliver a large volume of air at slow speed. Blades are riveted to a cast iron hub. Power is applied to shaft by means of grooved pulleys and a V-belt. Motor is rubber mounted to eliminate hum and vibration.
SIZES AND CAPACITIES—Four sizes ranging from 30 in. to 48 in. diameter with capacities of 5750 to 15,000 c.f.m.
MADE BY—*Chelsea Fan & Blower Co., Inc., 370 W. 15 St., New York.* *15*



Reps Extractor

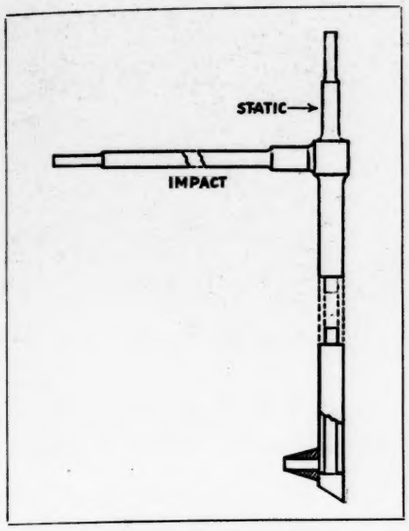
NAME—Reps pipe and stud extractor.
PURPOSE—For extracting broken pipe and studs.
FEATURES—The manufacturer states that the patented four-point grip prevents the extractor from reaming and assures a strong bite without hammering or pounding. The shallow grip is said to greatly lessen any expansion and jamming. A built-in reamer automatically removes burrs from pipe, eliminating interference with extractor's bite and minimizing cause for expansion of broken piece. The extractor is made of heat-treated forged steel with a Brinell hardness of 490. A permanent rustproof surface is provided by means of electrolytically plated cadmium.
TYPES AVAILABLE—Complete set of 10 fits all sizes of pipe from 1/8 to 2 in. and studs, screws, nuts and bolts from 7/16 to 3 1/2 in.



MADE BY—*Reps Tool Co., Inc., 220 Delaware Ave., Buffalo, N. Y.* *16*

Arco Thermo Heating System

NAME—Arco thermo heating system.
PURPOSE—A warm water heating system utilizing radiators and fans for air distribution in the rooms.
FEATURES—System is a completely automatic forced circulation warm water system, including a pump which accelerates the circulation of water through the piping and thermo units. The boiler may be fired either by oil burner, coal stoker, or gas burner. Warm water is distributed through copper pipes to the room heaters which are called Arco thermo units. The Arco thermo units are composed of a radiator and fan driven by a compressed air motor. This air motor, which is said to be thin, compact, and dirtproof, makes it possible to conceal the motor element within the narrow limits of an ordinary building wall. Radiator and fan are assembled into a galvanized steel box 10 in. wide, 14 ½ in. high, and 4¼ in. deep, recessed flush with the wall and off the floor. All piping connections are made within this box, which is covered with an ivory enamel grille. Air is supplied to the motors through a single small diameter copper pipe by a motor-driven air compressor and storage tank located in the basement. A speed control on each motor makes it possible to regulate the amount of heat given off by each radiator. System consists of an Ideal warm water boiler, copper pipe and copper fittings, water circulator, float control valve, expansion tank, air supply unit, thermostat, relay, and thermo unit. The Arco thermo units are made in one standard size of 50 sq. ft. equivalent cast iron radiator capacity. For rooms requiring less than 50 ft., capacity is reduced by reducing fan speed. Additional units may be used for more than 50 ft. Manufacturer claims the following advantages over conventional systems: More floor space, instant response to heat thermostats, prevention of drafts, and the lowering of room temperature differential.
MADE BY—*American Radiator Co., 40 W. 40th St., New York.* *17*



Ellison Pitot Tube

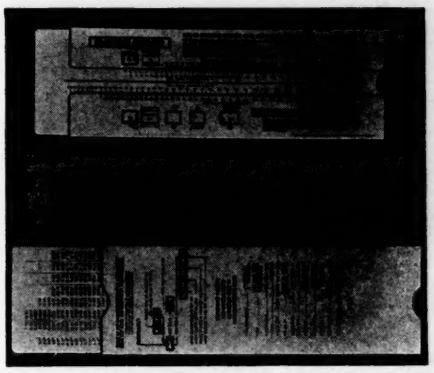
NAME—Straight-stem type pitot tube.
PURPOSE—For measuring air velocities in thick wall ducts.
FEATURES—This tube was designed especially for use in thick wall ducts in which the angle type cannot be conveniently inserted. The outer tube is 5/16 in. outer diameter, the flow end of which is machined at an angle of 59° and is said to transmit a true static pressure through the 1/8 in. inner tube when faced at right angles to the flow. By means of a conical tip, facing the flow, a true impact pressure is transmitted through the outer tube.
MADE BY—*Ellison Draft Gage Co., 214 W. Kinzie St., Chicago, Ill. 18*

Yeomans Condensation Pump

NAME—Yeomans Hot Shot condensation pump.
PURPOSE—For returning condensate to steam boiler.
FEATURES—The operating unit of this device is the Yeomans Motopump which has a balanced bronze impeller mounted on a rustproof steel motor shaft. It is equipped with sealed grease-lubricated ball bearings and a special shaft seal. The receiver is welded copper bearing steel. Adjustment of the float on the float switch is made from outside of the receiver. Unit is shipped complete ready for pipe and electrical connections.
CAPACITIES—Capacities range from 1½ to 25 g.p.m.
MADE BY—*Yeomans Brothers Co., 1433 Dayton St., Chicago. 19*

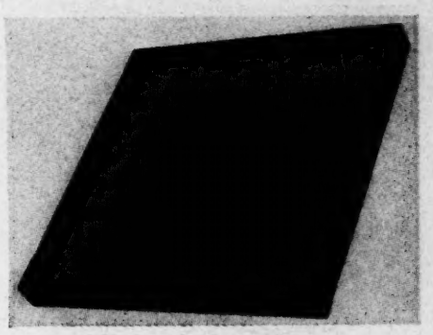
Air Condition Calculator

NAME—Air Condition calculator.
PURPOSE—For the accurate determination of all of the important properties of air.
FEATURES—This calculator is in the form of a pocket slide rule and is made of a substance similar to celluloid. When two of the following are known —dry bulb, wet bulb or dewpoint temperature—this chart makes it possible to determine all the other properties of the air.
METHOD OF OPERATION—On the front side of the calculator there are two sets of scales. Scales C and D combine the relationship between dry bulb and wet bulb to obtain relative humidity, while scales A and B combine the relationship between dry bulb and dewpoint to obtain relative humidity. The other properties of the air are found on the back of the calculator. Among these are sensible heat, volume, total heat, grains of moisture, latent heat, volume of vapor and the vapor pressure. A table of conversion factors commonly used in air conditioning work is also included.
PRICE—$1.50.
MADE BY—*Calculator Specialties Co., 122 S. Michigan Ave., Chicago. 20*



Byron Jackson Deep Well Pump

NAME—Submersible deep well turbine pump.
PURPOSE—For pumping water from deep, shallow, crooked or straight wells, sumps or natural bodies of water.
FEATURES—This pump has its motor below and not above the turbine bowls as is usual practice. The propelling shaft is said to be very short and the long, small diameter motor operates submerged at all times in the well water. The liquid pumped does not come in contact with the electrical parts or bearings as these are enclosed in an oil-filled case with a mercury seal where the shaft passes through at the top. The turbine and the submersible motor form a unit that is attached to and supported by the discharge pipe. A submarine armored cable and small copper oil tube form the only connection aside from the discharge pipe between the pumping unit and the surface of the ground. Motor is of the squirrel cage induction type and its rotor is carried on two ball bearings. A high dielectric oil is circulated through the entire windings at all times.
MADE BY—*Byron Jackson Co., Dept. 128, Los Angeles, Calif. 21*

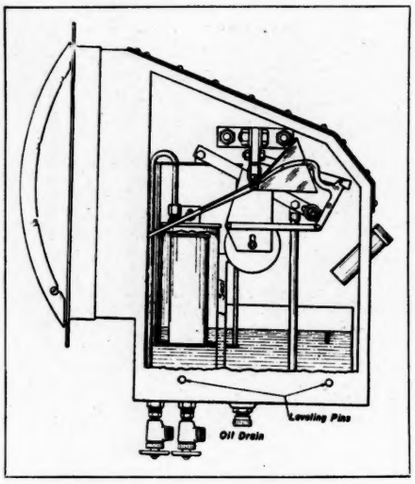


Burgess Air Filter

NAME—Long life air filter.
PURPOSE—A throw-away type filter for warm air furnaces, ventilating, and air conditioning systems.
FEATURES—Air is cleaned as it impinges against layers of expanded fiber which have been sprayed with a sticky compound. Three sections, a coarse, medium, and fine mesh, make up the completed filter. Each section consists of seven layers of expanded fiber. Tests indicated that the filter will hold 132 grams of standard dust for every square foot of frontal area. Filter's efficiency ranges from 86 to 100%, depending upon the size of the dust. When the filter is new the resistance to air flow at 250 f.p.m. is 0.01 in. of water.
MADE BY—*C. F. Burgess Laboratories, Inc., 111 W. Monroe St., Chicago. ...22*

Carrier Dehydrator

NAME—Carrier silica gel dehydrator.
PURPOSE—For removing moisture from air without the use of refrigeration.
FEATURES—Dehumidification of air is accomplished by the application of the dehydrating quality of silica gel. Silica gel is a hard synthetic substance having the appearance of clear quartz granules. When moisture is brought in contact with a quantity of silica gel it will take up 40% of its weight in moisture and still remain dry on the surface. This moisture can be removed from the silica gel by the application of heat so that the gel is then capable of adsorbing a low quantity of moisture again. The equipment employed consists of a series of silica gel trays or beds, motor-driven fans to convey the air to be dehydrated, a gas heater to produce the reactivating air, and automatic controls for continuous operation. All of these are self-contained in a suitable housing.
SIZES AND CAPACITIES—Four sizes ranging in air handling capacities from 600 to 5000 c.f.m. with moisture removal capacities ranging from 25 lb. per hr. for the 600 c.f.m. unit to 210 lb. per hr. for the 5000 c.f.m. unit. These capacities are based on an entering wet air condition of 9 grains per cu. ft.
MADE BY—*Carrier Corp., Syracuse, N. Y. 23*



Ellison Air Flow Gage

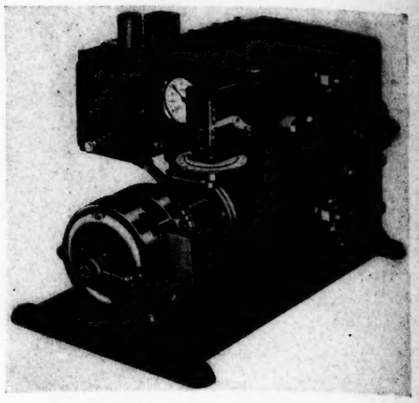
NAME—Ellison air flow gage.
PURPOSE—To give accurate flow measurements of air and gases across an orifice in cubic feet per minute or cubic feet per hour.
FEATURES—This gage incorporates a square root movement which consists of a pointer with camtrack in the counter weight of the pointer and a cam linked to the gravity arm of the power unit. The pointer is carried on knife edge fulcrum bearings underneath the fulcrum bearings of the power unit. The power unit consists of a powerful gasometer bell moving within a stationary bell. This differential system is said to eliminate buoyancy loading weight with plus pressure, thereby increasing the sensitivity of the gage. The bell is provided with a seal which prevents the oil from being blown out of the pan under pressure surges in excess of the scale range. It is said that the gage repeats perfectly down to 0.06 in. differential with a 4 in. differential pressure.
MADE BY—*Ellison Draft Gage Co., 214 W. Kinzie St., Chicago, Ill.* 24

Delco Stoker

NAME AND MODEL NUMBER—Delco stoker, Standard 50, Special 30, and Standard 30.
PURPOSE—For automatic burning of bituminous coal.
FEATURES — These stokers are designed to take care of installations requiring up to 30 or 50 lb. of coal per hr. The large model has a hopper holding 400 lb. of coal while the two smaller models will hold 300 lb. One of these smaller models is of standard construction while the other, the Special 30, has certain features omitted. The hopper sides adjacent to the coal are treated with a rubberized cement which completely covers all exposed surfaces. This cement is said to resist the abrasive action of the coal and acids formed in moist damp coal. Both of the standard models are soundproof with 1 in. of sound insulation. The speed reducer mechanism operates with an impulse action which in effect is said to transmit hammer blows through the feed worm to the fuel bed so as to prevent the caking action of the coal. The overload protection consists of a thermo-actuated cut-out in the motor and a double shear pin. All models have three coal feeding units, the large size having rates of 17, 34, or 51 lb. per hr. and the two smaller sizes, rates of 10, 20, or 30 lb. per hr. Incorporated on all devices is an automatic spike catcher. Controls include a heat anticipating thermostat, limit or protective control and a pilot light or hold fire control.
SIZES AND CAPACITIES—Made in three models with capacities of either 50 or 30 lb. per hr.
MADE BY — *Delco-Frigidaire Conditioning Division, General Motors Sales Corp., Dayton, Ohio.* 25

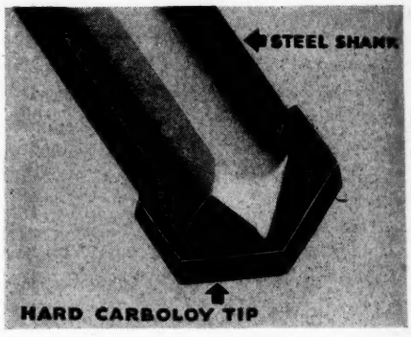
Reeves Variable Speed Control

NAME—Reeves Vari-Speed Motodrive.
PURPOSE — This device is a speed control unit designed to automatically regulate speed from pressure variation as in stoker feed on a boiler or maintenance of constant fluid pressure in a pipe line or tank upon which there is a variable demand.
FEATURES — Complete control consists of a bellows shifting mechanism mounted on the Motodrive, an adjustable pressure reducing valve, auxiliary valves, and connecting pipes. Fluid pressure is transmitted by means of water, oil, steam, gas or air by a valve through piping to the bellows shifting mechanism which operates to increase or decrease speed on the Motodrive and hence on the driven machine. Speed of shifting depends on the kind of fluid used. Air is fastest and will shift the control over the widest (6 to 1) ratio through its complete speed range in from 2 to 4 seconds. The manufacturer states that speed changes are smooth and gradual over the entire range of the unit and desired speed settings are maintained as long as wanted. The amount of pressure required varies with the size of the Motodrive and on the largest unit ranges from 5 lb. per sq. in. to 30 lb. Pressure gages may be used to indicate relative speed.
MADE BY—*Reeves Pulley Co., Columbus, Ind.* 26



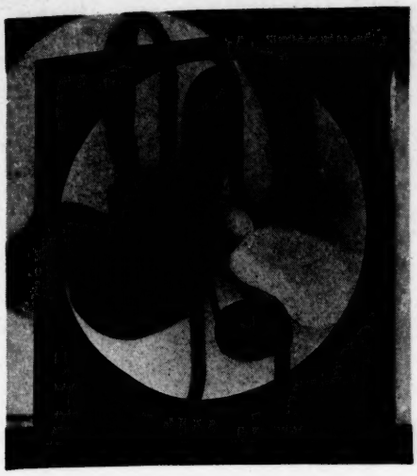
Sterling Vacuum Pump

NAME AND MODEL NUMBER—Sterling vacuum pump, type S.
PURPOSE—For producing vacuum on the returns of heating systems and delivering condensate to the boiler.
FEATURES—Outstanding features of this pump are: (1) Its compactness; (2) all piping and working parts are enclosed inside of a cast iron receiver; (3) an entirely new pilot-operated bellows type discharge valve which is used in the pumping unit for the discharge of the water to the boiler.
SIZES AND CAPACITIES—Sizes from 2500 sq. ft. to 65,000 sq. ft.
LITERATURE AVAILABLE—Bulletin No. 372.
MADE BY—*Sterling Engineering Co., 3738 N. Holton St., Milwaukee, Wis.*..27



Carboloy Drill

NAME—Carboloy flat drill.
PURPOSE—For drilling holes in all types of non-metallic construction materials.
FEATURES—This drill contains a cutting edge made of Carboloy cemented carbide, a material which is said to be harder than the hardest steel and closely approaching the hardness of diamonds. Advantages claimed for the drill are the ability to drill holes at least 50% faster, hold a sharp cutting edge for long periods of use, produce smooth, accurate holes and eliminate difficulties ordinarily encountered when drilling glazed surfaces such as on tile.
LITERATURE AVAILABLE—Bulletin No. FD-124.
MADE BY—*Carboloy Co., Inc., 2985 E. Jefferson Ave., Detroit, Mich.* 28



Viking Attic Fan

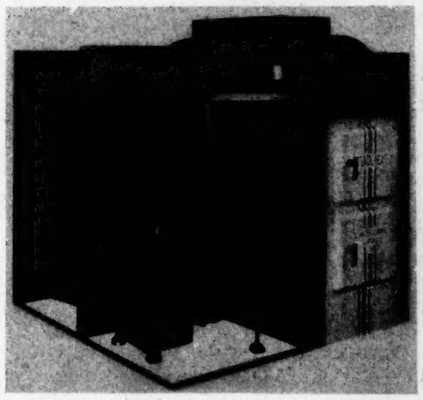
NAME—Viking CirCOOLator.
PURPOSE—For cooling by means of large volumes of night air.
FEATURES—The blade shape, pitch, number of blades and speed of the fan have been designed to make the fan inaudible when operated. All parts of the fan have been streamlined and the three supporting members are located well away from the fan blades so as not to interfere with the air flow. A streamline hub on the fan combines the bearing hub and fan pulley into one assembly. The bearing is concealed inside the assembly and turns around a shaft. This bearing is made of a special bronze which has the property of absorbing the oil and retaining it so that the fan might run for several weeks without lubrication if necessary.
SIZES AND CAPACITIES—Made in three sizes having capacities of 7500, 11,500 and 16,500 c.f.m., respectively. Modified design with larger motors and slightly higher speed is also available for commercial use.
MADE BY—*Viking Air Conditioning Corp., Main and Center Sts., N.W., Cleveland, Ohio.* *29*

General Electric Air Conditioner

NAME AND MODEL NUMBER—Unit air conditioner, Model FD-30.
PURPOSE—For summer conditioning of small stores, shops, restaurants and offices.
FEATURES—Conditioner performs the function of cooling, dehumidifying, circulating and filtering. It consists of two independent sections bolted together, the lower section holding the condensing unit and the upper the air conditioner. In operation air is drawn into the unit through a perforated sheet-steel grille and discharged through louvers located at the top. Approximately 1275 c.f.m. of air is conditioned. Unit is acoustically lined to provide quiet operation. Switches are controlled manually although thermostatic or time control can be applied if wanted. Unit requires water, drain and electrical connections. Condensing section may be purchased separately where an enclosed condensing unit is required. Condensing unit has a 3-hp. motor which contains a shell and finned coil condenser receiver. A water-cooled coil is provided to remove heat from inside the enclosure. Upper half or air conditioner section may also be ordered separately. Its essential parts consist of a four-row cooling coil assembly with a 12-in. double inlet fan driven by a 1/4-hp. motor.
CAPACITIES—Gross cooling capacity of approximately 39,000 B.t.u. per hr. with an air circulation of 1275 c.f.m.
MADE BY—*General Electric Co., Schenectady, N. Y.* *30*

Schwitzer-Cummins Conditioner

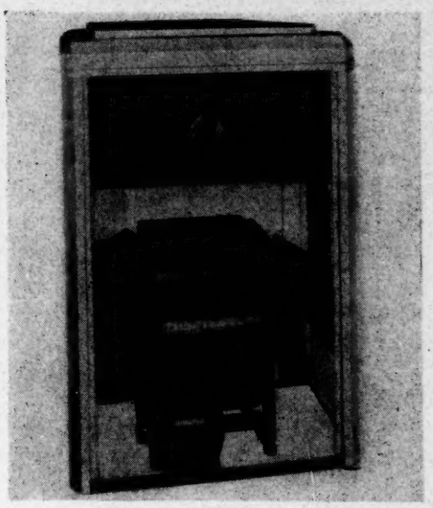
NAME—Schwitzer-Cummins conditioner.
PURPOSE—For supplying warm air using automatically fired coal as a fuel.
FEATURES—Conditioner consists of a stoker furnace, Stokol stoker, blower-filter air cleaner and circulator, and humidifier built into a single cabinet. The stoker furnace is a steel welded unit and resembles the construction of



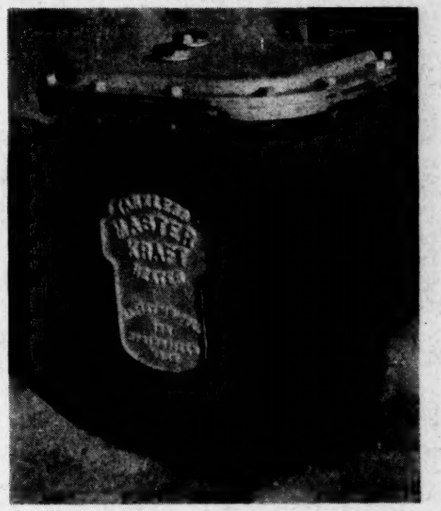
a water tube boiler. There are no cemented seals and a clinker compartment and clinker removal bucket have been provided for convenience in cleaning the fire.
SIZES AND CAPACITIES—Two sizes, Model 200, maximum rating 200,000 B.t.u. per hr. at bonnet, nominal rating 130,000 B.t.u. per hr.; Model 300, maximum rating 300,000 B.t.u. per hr. at bonnet, normal rating 200,000 B.t.u. per hr.
MADE BY—*Schwitzer-Cummins Co., 1125 Massachusetts Ave., Indianapolis, Ind.* *31*

Majestic Super-Heater Blower Unit

NAME—Super-Heater blower unit.
PURPOSE—To recover heat from the flue gases from oil- or gas-fired gravity warm air furnaces and to convert to forced air.
FEATURES—This unit is composed of a radiator, filters and blower unit. It is installed on the furnace radiator



outlet and is designed to recover heat from the flue gases. Approximately 44 sq. ft. of heating surface is used to preheat the cold air as it is pulled from the blower unit through the filters and forced into the main heating plant. Three filters are used. The blower, which is of the high pressure type, will deliver 1600 c.f.m. and is mounted for quiet operation. Casing is finished in a blue ripple.
MADE BY—*Majestic Co., Huntington, Ind.* *32*



Harvey-Whipple Tankless Heater

NAME—Master Kraft tankless heater.
PURPOSE—For supplying hot water without the use of storage tanks.
FEATURES—Unit is designed for use with steam, vapor, or hot water heating systems. Coils are of heavy gage copper with a large cleanout port. Extra large connections and casing is said to make a high output possible.
SIZES AND CAPACITIES—Two sizes; capacities of 220 gal. per hr. and 300 gal. per hr., respectively, with 100F rise. This performance based on hot water temperature of 180F.
MADE BY—*Harvey-Whipple, Inc., Springfield, Mass.* *33*

Degree-Day Figures for March, 1938

HEATING & VENTILATING continues its tenth year of publishing degree-day data for various large cities

	Albany, N. Y.	Atlanta, Ga.	Baltimore, Md.	Birmingham, Ala.	Boston, Mass.	Buffalo, N. Y.	Burlington, Vt.
Degree-days for March, 1938.....	801	217	496	156	802	845	1043
Degree-days, Sept. 1, '37, to Mar. 31, '38	5534	2668	3786	2295	5108	5751	6654
Degree-days, Sept. 1, '36 to Mar. 31, '37	5377	2507	3738	2215	4860	5595	6513
Degree-days, Sept. 1, to Mar. 31, Normal	5848	2758	4163	2283	5230	5800	6584

	Cheyenne, Wyo.	Chicago, Ill.	Cincinnati, Ohio	Cleveland, Ohio	Columbus, Ohio	Denver, Colo.	Des Moines, Iowa
Degree-days for March, 1938.....	881	623	502	675	562	693	600
Degree-days, Sept. 1, '37, to Mar. 31, '38	5809	5282	4404	5063	4689	4522	5503
Degree-days, Sept. 1, '36 to Mar. 31, '37	6573	5465	4458	4986	4671	5393	6121
Degree-days, Sept. 1, to Mar. 31, Normal	6174	5493	4345	5371	4891	5073	5825

	Detroit, Mich.	Dodge City, Kan.	Duluth, Minn.	El Paso, Tex.	Erie, Pa.	Evansville, Ind.	Fort Wayne, Ind.
Degree-days for March, 1938.....	729	481	1002	239	754	368	656
Degree-days, Sept. 1, '37, to Mar. 31, '38	5626	4185	7794	1996	5361	3771	5373
Degree-days, Sept. 1, '36 to Mar. 31, '37	5618	4950	8470	2667	5166	4026	5397
Degree-days, Sept. 1, to Mar. 31, Normal	5691	4646	7911	2383	5407	3968	5321

	Fort Worth, Tex.	Grand Rapids Mich.	Green Bay, Wis.	Harrisburg, Pa.	Hartford, Conn.	Indianapolis, Ind.	Ithaca, N. Y.
Degree-days for March, 1938.....	114	713	896	633	748	548	772
Degree-days, Sept. 1, '37, to Mar. 31, '38	1980	5630	6669	4672	5168	4793	5634
Degree-days, Sept. 1, '36 to Mar. 31, '37	2636	5694	6900	4563	4965	4857	5675
Degree-days, Sept. 1, to Mar. 31, Normal	2121	5827	6903	4880	5303	4855	5871

	Kansas City, Mo.	Knoxville, Tenn.	La Crosse, Wis.	Lansing, Mich.	Lincoln, Neb.	Little Rock, Ark.	Los Angeles, Calif.
Degree-days for March, 1938.....	406	271	764	761	592	177	231
Degree-days, Sept. 1, '37, to Mar. 31, '38	4308	3160	6317	5974	5108	2627	832
Degree-days, Sept. 1, '36 to Mar. 31, '37	4846	2965	6974	6076	5818	3013	1282
Degree-days, Sept. 1, to Mar. 31, Normal	4537	3460	6611	6237	5483	2733	1255

	Louisville, Ky.	Madison, Wis.	Memphis, Tenn.	Milwaukee, Wis.	Minneapolis, Minn.	Nashville, Tenn.	New Haven, Conn.
Degree-days for March, 1938.....	403	751	186	731	834	267	732
Degree-days, Sept. 1, '37, to Mar. 31, '38	3931	6274	2679	5789	6826	3159	4878
Degree-days, Sept. 1, '36 to Mar. 31, '37	4052	6671	3028	5991	7503	3255	4724
Degree-days, Sept. 1, to Mar. 31, Normal	3916	6611	2854	6208	7044	3327	5129

	New Orleans, La.	New York, N. Y.	Norfolk, Va.	Oklahoma City, Okla.	Omaha, Neb.	Peoria, Ill.	Philadelphia, Pa.
Degree-days for March, 1938.....	28	645	350	260	623	544	597
Degree-days, Sept. 1, '37, to Mar. 31, '38	1138	4405	2957	3167	5403	5136	4197
Degree-days, Sept. 1, '36 to Mar. 31, '37	1059	4269	2767	3780	6184	5400	4055
Degree-days, Sept. 1, to Mar. 31, Normal	1024	4706	3104	3451	5633	5535	4385

	Pittsburgh, Pa.	Portland, Me.	Portland, Oreg.	Providence, R. I.	Reading, Pa.	Reno, Nev.	Richmond, Va.
Degree-days for March, 1938.....	558	966	563	770	606	821	380
Degree-days, Sept. 1, '37, to Mar. 31, '38	4563	5903	3285	5038	4452	4481	3425
Degree-days, Sept. 1, '36 to Mar. 31, '37	4432	5620	3758	4786	4394	5180	3356
Degree-days, Sept. 1, to Mar. 31, Normal	4734	6002	3732	5206	4876	4902	3487

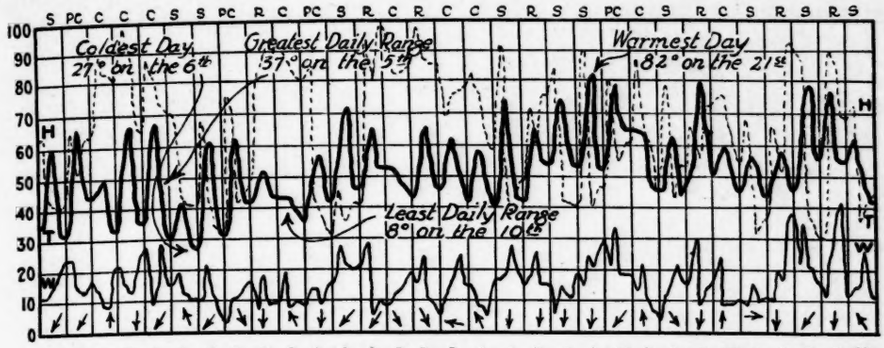
	Rochester, N. Y.	St. Louis, Mo.	Salt Lake City, Utah	San Francisco, Calif.	Scranton, Pa.	Seattle, Wash.	Spokane, Wash.
Degree-days for March, 1938.....	763	358	724	381	720	573	740
Degree-days, Sept. 1, '37, to Mar. 31, '38	5601	4020	4056	1883	5246	3347	4876
Degree-days, Sept. 1, '36 to Mar. 31, '37	5487	4381	5319	2244	5182	3854	5989
Degree-days, Sept. 1, to Mar. 31, Normal	5854	4309	4866	2123	5445	3931	5485

	Springfield, Ill.	Syracuse, N. Y.	Toledo, Ohio	Trenton, N. J.	Utica, N. Y.	Washington, D. C.	Wichita, Kan.
Degree-days for March, 1938.....	457	775	667	653	952	478	410
Degree-days, Sept. 1, '37, to Mar. 31, '38	4628	5492	5328	4521	6145	3865	3995
Degree-days, Sept. 1, '36 to Mar. 31, '37	4927	5440	5364	4406	5687	3781	4631
Degree-days, Sept. 1, to Mar. 31, Normal	4951	5984	5372	4450	5955	4253	4421

Methods of applying the degree-day in connection with the operation of heating plants or for the prediction of fuel consumption of heating plants are described fully in the new enlarged edition of the DEGREE-DAY HANDBOOK, published by HEATING & VENTILATING, 148 Lafayette Street, New York, price $3. Degree-days as given above for a "normal" month or season are based on averages for a long period of years, ending about 1922. Averages covering different periods will disagree with the above figures slightly.

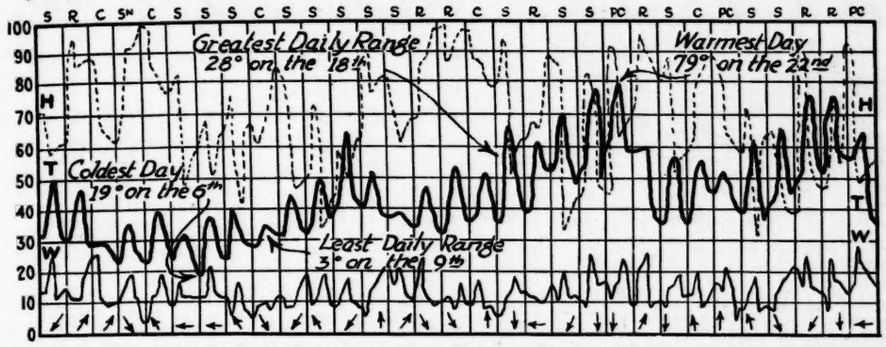
THE WEATHER FOR MARCH, 1938

Plotted from records compiled for HEATING & VENTILATING by the U. S. Weather Bureau. Heavy curves (T), dry bulb temperatures in deg. F.; dotted lines (H), per cent relative humidity from readings at 8 a.m., noon, and 8 p.m. Light lines (W), wind velocity in m.p.h. Arrows indicate wind direction at maximum velocity, north being arrow pointing up, etc.; S—clear; PC—partly cloudy; C—cloudy; R—rain; Sn—snow.



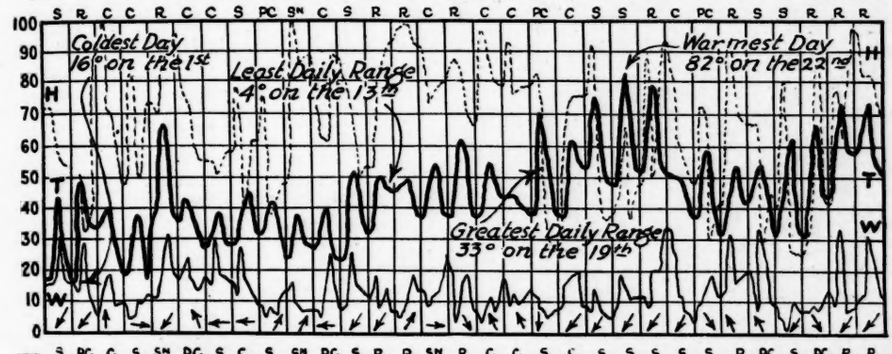
St. Louis

Mean temp. for month, 53.7F; aver. wind velocity, 14.2 m.p.h.; prevailing direction of wind, S.



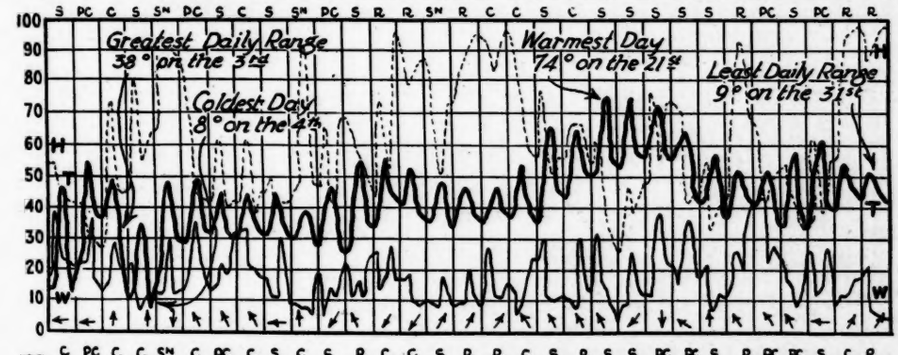
Chicago

Mean temp. for month, 45.0F; aver. wind velocity, 12.2 m.p.h.; prevailing direction of wind, SW.



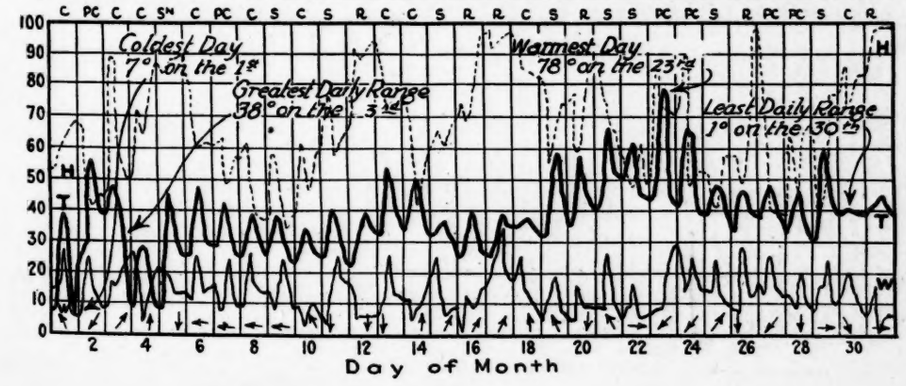
Pittsburgh

Mean temp. for month, 45.4F; aver. wind velocity, 12.2 m.p.h.; prevailing direction of wind, SW.



New York

Mean temp. for month, 44.2F; aver. wind velocity, 15.7 m.p.h.; prevailing direction of wind, NW.


Coldest Day
7° on the 1st
Warmest Day
78° on the 23rd
Greatest Daily Range
38° on the 3rd
Least Daily Range
1° on the 30th
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

Boston

Mean temp. for month, 39.1F; aver. wind velocity, 12.6 m.p.h.; prevailing direction of wind, W.

Industrial Exhaust Ventilation—
Piping Design

(Concluded from page 47)

lar to Fig. 59 with the proposed dimensions and lengths. Pressures and volumes should check within 10% and 5% respectively.

The contractor who is reluctant to submit these engineering details casts doubt on his own competence. It should be evident that there is no mystery connected with adequate exhaust design and that there are no trade secrets worthy of the name. Consequently, it is fair and ethical for the buyer to insist that he be shown exactly what the contractor proposes to furnish and how he expects to accomplish his predicted results. Checking a number of competitive proposals will disclose a wide difference in the competence of the respective designers and frequently will explain excessively low or high bids.

NEW TRADE LITERATURE

Air Conditioning Controls. A standard-size, 10-page condensed bulletin, No. K, of the Julien P. Friez air conditioning products. Includes descriptions and list prices of humidistats, windowstats, thermostats, hytherstats, microstats, gas valves, water valves, motor operators, relays, portable recorders, psychrometers and air measuring instruments. JULIEN P. FRIEZ & SONS, INC., BALTIMORE, MD. 34

Air Conditioning Instruments. A standard-size, 40-page catalog, No. 65, covering the Moeller line of instruments for air conditioning, heating and ventilating. Among the instruments described are thermometers for air ducts, ammonia lines, drying rooms, water lines and water tanks. Other instruments include hygrometers, psychrometers, recording thermometers and recording psychrometers. MOELLER INSTRUMENT CO., 132ND ST. AND 89TH AVE., RICHMOND HILL, N. Y.....35

Air Eliminator. A four-page, standard-size bulletin, No. 106, describing the Gorton high pressure air eliminator. This device is used for the automatic venting of dryers, steam coils, steam mains, unit heaters, and laundry equipment operating under steam pressures up to 150 lb. GORTON HEATING CORP., CRANFORD, N. J.....36

Attic Ventilation. A standard-size, 20-page manual on attic ventilation using the Viking CirCOOLator. This manual has been compiled for the dealer-installer and represents the combined engineering and sales experience of manufacturers. Presents information on how buildings are cooled by attic ventilation, gives Weather Bureau figures showing actual drop in temperature during the night and tells how to select and install the proper size CirCOOLator. VIKING AIR CONDITIONING CORP., MAIN & CENTER STS., N. W. CLEVELAND, OHIO. 37

Boiler Meters. A 32-page bulletin entitled "Bailey Boiler Meters" containing an analysis of 7000 combustion tests made on all types and sizes of boilers. Bulletin shows graphically the average percentage of excess air with which various classifications of boiler units are working in actual practice. Also shows the percentage occurrence of limiting factors in reducing excess air for combustion under boilers with various types of firing and furnace wall construction. BAILEY METER CO., CLEVELAND, OHIO. 38

Corrosion. A small size, 65-page handbook entitled "Modern pH and Chlorine Control." The first 24 pages are devoted to a discussion of the meaning of pH control from the standpoint of calorimetric and electrometric methods. Following this is a discussion of the application of pH controls to various problems and detailed descriptions of modern equipment for the control of pH, chlorine and phosphate, and for water analysis. W. A. TAYLOR & CO., INC., 872 LINDEN AVE., BALTIMORE, MD. 39

Electric Motors. A standard-size, eight-page bulletin, 1020-A, describing the Bodine fractional horsepower motors. Motors covered range from 1/2000 to 1/6 hp. with all types of windings. BODINE ELECTRIC CO., 2254 W. OHIO ST., CHICAGO, ILL. 40

Exhaust Fans. A 16-page, standard-size catalog, X2459, illustrating and describing Emerson-Electric exhaust fans, shutters and protective mesh guards, kitchen ventilating equipment and Seabreeze kitchen ventilators. Includes information on where and how to install exhaust and ventilating fans and how to determine the most effective size of fans. Also includes dimension, performance and prices. THE EMERSON ELECTRIC MFG CO., ST. LOUIS, MO. 41

Exhaust Systems. A 28-page catalog, ID, covering the DeVilbiss line of spray booths and exhaust systems as well as other spray-painting and finishing equipment. Full specifications on all standard items are given. THE DEVILBISS CO., TOLEDO, OHIO 42

Flexible Pipe. A standard-size bulletin, No. 20-A, describing the Atlantic Metal Hose line of metallic hose designed for use for vibration absorbers in air conditioning and refrigeration equipment, fuel oil connections on oil burners or for connecting steam lines between steam heated multiples. Gives information on the construction, strength and method of specifying. ATLANTIC METAL HOSE CO., INC., 123 W. 64th ST., NEW YORK. 43

(Continued on page 76)

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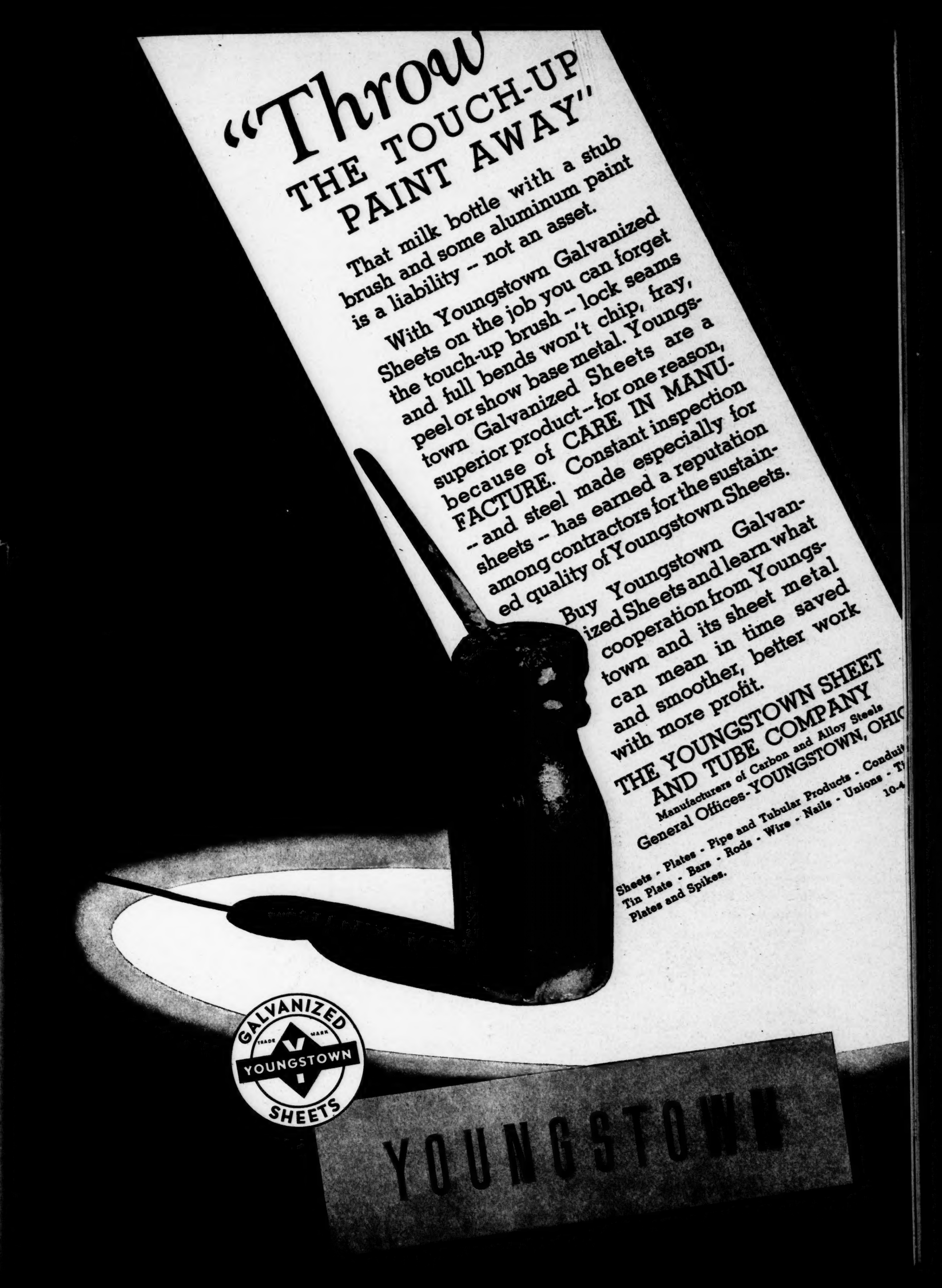
"Throw
THE TOUCH-UP
PAINT AWAY"
That milk bottle with a stub brush and some aluminum paint is a liability -- not an asset.
With Youngstown Galvanized Sheets on the job you can forget the touch-up brush -- lock seams and full bends won't chip, fray, peel or show base metal. Youngstown Galvanized Sheets are a superior product -- for one reason, because of CARE IN MANUFACTURE. Constant inspection -- and steel made especially for sheets -- has earned a reputation among contractors for the sustained quality of Youngstown Sheets.
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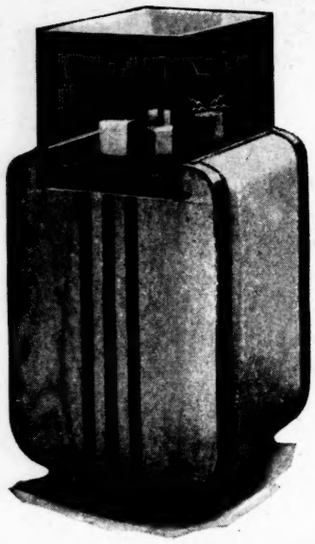


This "DRY-PAC" Test Stand Shows it Stands the Test!

A UNIQUE electric test on Dry-paC Waterproof Asbestos Insulation, made on the device illustrated above, attracted considerable attention at the recent New York Heating and Ventilating Show. Dry-paC, along with 3 other specimens of best grade commercial pipe covering, each 5" thick, were inserted in this test machine, with the lower portion of each standing in ½" of water. Excepting Dry-paC, *all absorbed sufficient moisture* to carry electric current, and to produce a visible spark from a rotating terminal of high voltage. The essence of efficiency for underground steam insulation is DRYNESS—*Dry-paC has it!*

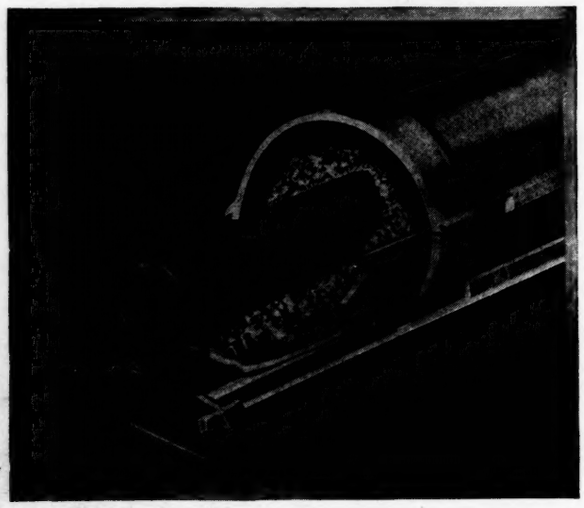
Prevent leakage and loss in your steam lines, keep them tight, dry and 90% efficient with a Ric-wiL Tile or Cast Iron System. Ric-wiL service is complete from design to installation and tests. On any subsoil steam conveyance problem—under-supply, fuel waste, loss in transit—Ric-wiL can give you effective assistance. Write for complete catalog and Dry-paC test sample.

The RIC-WIL Co., Union Trust Bldg., Cleveland, Ohio

New York San Francisco Chicago

Agents in principal cities

Unlike some other insulations, Dry-paC "stands the weather"—does NOT deteriorate under action of the elements.



REGISTERED IN U. S. PATENT OFFICE

RIC-WIL

CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

(Continued from page 74)

Instruments. A standard-size, four-page bulletin, No. 94-1, entitled "The Brown Pneumatic Remote Transmission System." Bulletin describes this system developed by the Brown Instrument Company for remote transmission of measurement and control in hazardous atmospheres where the use of electrical transmission is not permissible. The principle of operation and construction of the transmitting unit are illustrated by schematic diagrams. THE BROWN INSTRUMENT CO., WAYNE & ROBERTS AVES., PHILADELPHIA, PA. 44

Pipe Fittings. A 16-page booklet, Form 381A, describing the Dresser line of No-Thread fittings, Style 65. The fittings covered by this booklet are self-contained pipe joints that connect pipe without threading. These joints are suitable for use with oil, gas, water, or air. S. R. DRESSER MFG. CO., BRADFORD, PA. 45

Prefabricated Ducts. A standard-size, 12-page catalog, No. 38, describing the Lamneck simplified system of prefabricated ducts. Includes descriptions of the three types of prefabricated duct systems and illustrations of the various fittings available. Also list prices and dimensions of the fittings. LAMNECK PRODUCTS, INC., 416-436 DUBLIN AVE., COLUMBUS, OHIO. 46

Prefabricated Ducts. A standard-size, 22-page bulletin, No. 27 A-C, entitled "Air Conditioning Fitting Catalog." Catalog illustrates and lists a wide variety of prefabricated ducts, gives information on dimensions and list prices of the various fittings. UNITED STATES REGISTER CO., BATTLE CREEK, MICH. 47

Refrigeration Tools. A standard-size catalog, No. 38R, covering the Bonney line of refrigeration tools for servicing work. The booklet describes the complete line of extra small and standard sockets with detachable handles and attachments, special refrigeration sockets, refrigeration ratchets, wrenches, flaring tool, pinch-off tool, tube benders, open-end, box and miniature wrenches, as well as tools such as pliers, chisels, and screw drivers. BONNEY FORGE & TOOL WORKS, ALLENTOWN, PA. 48

Registers. A standard-size, 72-page register book, No. 38, illustrating and listing Auer registers, intakes and grilles for gravity heating and air conditioning systems. Catalog shows many models which are recent additions to the Auer line. Gives information on the dimensions, grille area and list prices. THE AUER REGISTER CO., 3608 PAYNE AVE., CLEVELAND, OHIO.....49

Speed Indicator. A standard-size, four-page bulletin, No. 715, describing the Standco speed indicator. This is a chronometric type tachometer and is said to be one of the most accurate of portable or hand speed measuring devices. Manufacturer states that the instrument can be read with ease to ½ r.p.m. HERMAN H. STICHT & CO., NEW YORK. 50

Stokers. Two standard-size, eight-page bulletins on the Conco stoker. One bulletin describes the heavy duty models while the other features the smaller size models. Included in the bulletins are descriptions of the outstanding features, illustrations of a number of typical installations, as well as illustrations of various models available. CONCO-SAMPSEL STOKER CORP., MENDOTA, ILL. 51

Unit Heaters. A 32-page illustrated bulletin entitled "Carrier Heat Diffusers." Bulletin presents engineering details in connection with unit heating with heat diffusers. Bulletin shows details of construction and gives diagrams and dimensional tables. Several pages are devoted to pipe size, application, connections, erection, and operating instructions. CARRIER CORP., SYRACUSE, N. Y. 52

Valves. A standard-size bulletin, No. 5-7000, entitled "Hancock Steel Valves." Bulletin describes the Hancock redesigned line of forged and cast steel valves, gives information on valve sizes, list prices and weights. HANCOCK VALVE DIVISION, MANNING, MAXWELL & MOORE, INC., BRIDGEPORT, CONN. 53

V-Belts. Two books entitled "V-Belt Data Book" and "V-Belt Conversion List." The V-Belt Data Book is a complete catalog containing information regarding the belt sizes and prices of Goodrich replacement belts for any one of 73 makes and 333 classifications of stokers and oil burners. There are also similar listings for water pumps, refrigerators, washing machines, and miscellaneous machines. The V-Belt Conversion List is a 16-page catalog which can be used by the dealer to find a Goodrich belt that can be interchanged with a belt of any other make. THE B. F. GOODRICH CO., AKRON, OHIO. 54

Welding. An 8½ x 11 in. bulletin entitled "How to Change Over to Welded Design for Profits." The bulletin is intended as an aid in applying electric welding to the design of machines and machinery structures and sets forth the experiences of many manufacturers who have redesigned their products for arc welding construction. THE LINCOLN ELECTRIC CO., CLEVELAND, OHIO. 55

Wrought Iron. An attractive 40-page circular entitled "Wrought Iron for Piping Systems." The purpose of this circular is to discuss the questions most frequently asked regarding the use of wrought iron for eliminating corrosion in pipe. The bulletin discusses pipe material costs, pipe selection, why some metals resist corrosion better than others, water supply, drainage, heating and power systems. Also included is a section devoted to installation procedure. Many pages are illustrated with piping installations. An especially valuable feature is statistical data on the life of various pipe materials in specific installations. A. M. BYERS CO., PITTSBURGH, PA. 56

WITH THE MANUFACTURERS

American District Steam Co., North Tonawanda, N. Y., has appointed *The Sheffler-Gross Co.*, Drexel Bldg., Philadelphia, representative for eastern Pennsylvania of its Adsco expansion joints, tile conduit, meters, water heaters, etc.

Blaw-Knox Co., Pittsburgh, has appointed *N. B. Ornitz* president of the Power Piping Division of the company, and *W. N. Quartz* vice-president in charge of operations. Mr. Ornitz, a director and a vice-president of the company, will also continue the management of the National Alloy Steel Division.

HOME OF COMMUNITY PLATE SILVER CUTS FUEL COSTS 15 P.C.

Webster Moderator System Heats Administration Building of Oneida Community, Ltd.

BETTER STEAM DISTRIBUTION

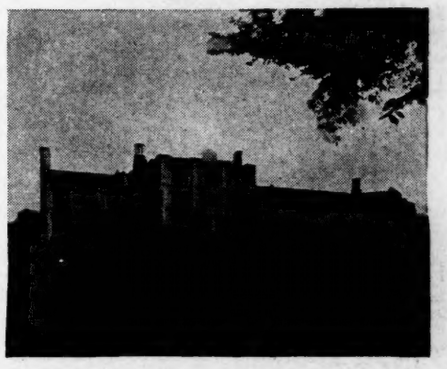
Heating Installation, Adequate When Building Was New, Gives Way to Modern Controls

INCREASED HEATING COMFORT

Sherrill, N. Y.—The makers of world-famed Community Plate Silver reduced fuel consumption 15 per cent in their modern Administration Building by installing a Webster Moderator System of Steam Heating.

The building is heated by gas from the mains of the Utica Gas and Electric Co., the 15 per cent savings figure being based on meter readings.

This substantial increase in heating effectiveness was accomplished in 1937, after a careful survey of the original installation, a Webster Vacuum System with temperature control in individual rooms, had indicated an opportunity for improved heating service.



Administration Building, Oneida Community, Ltd. Sherrill, N. Y.

With the Webster Moderator System, there has been a noticeable improvement in steam distribution. All sections of the building receive steam at the same time and approximately in accordance with need. An Outdoor Thermostat varies the basic rate of steam delivery with every change in weather conditions. A manual Variator allows the operator to adjust the steam supply to meet special conditions, such as heating-up or reduced night heating load.

There is a total of 9,676 square feet of installed direct radiation.

These before-and-after facts point the way to maximum comfort and economy in heating new buildings as well as in modernization of existing installations. Consult your architect, engineer or heating contractor. Or address

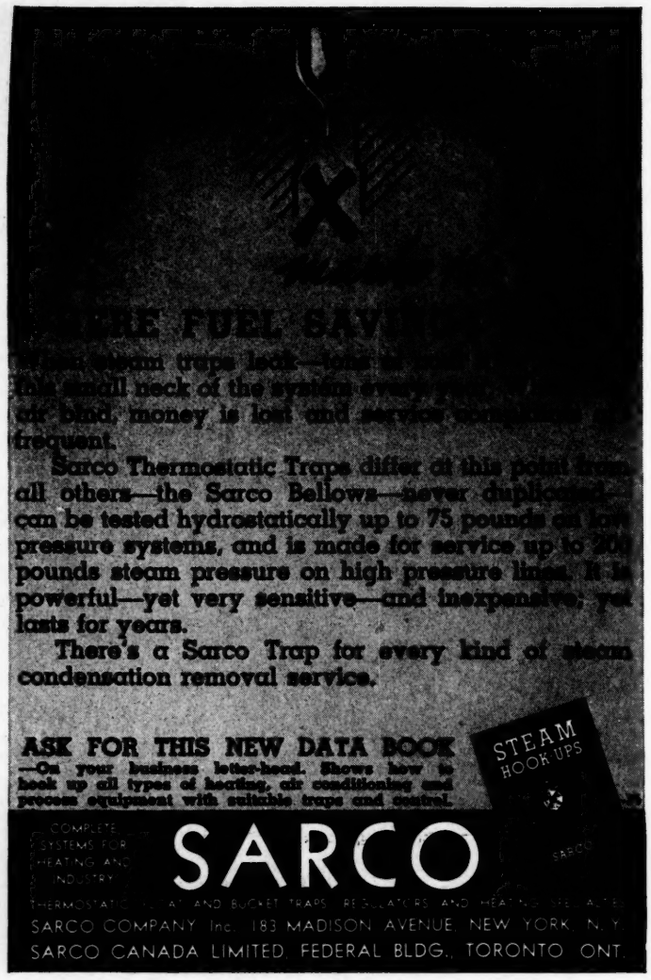
1888 WARREN WEBSTER & CO., CAMDEN, N. J. 1938

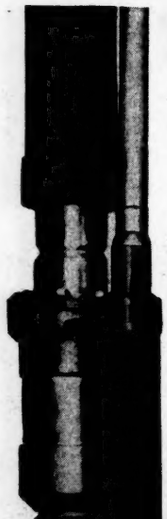
Pioneers of Modern Steam Heating

50 YEARS OF HEATING PROGRESS

Representatives in 60 principal U. S. Cities

WEBSTER MODERATOR CONTROL "Controlled by the weather"


ASK FOR THIS NEW DATA BOOK
—On your business letter-head. Shows how to hook up all types of heating, air conditioning and process equipment with suitable traps and control.
STEAM HOOK UPS
SARCO
SARCO COMPANY Inc. 183 MADISON AVENUE, NEW YORK, N.Y.
SARCO CANADA LIMITED, FEDERAL BLDG., TORONTO, ONT.



Stop VIBRATION NOISE

in Compressor Lines

Rex Vibra-Sorbers absorb vibration, stop noise, insure permanently quiet operation. Sweated into the compressor lines, they act as flexible couplings for speedy, trouble-free installation. All sizes available.

VIBRA-SORBERS

Made by
CHICAGO METAL HOSE CORPORATION
Maywood, Illinois

Carnegie-Illinois Steel Corp., Pittsburgh, has advanced *T. Lane Watson* to the position of assistant manager of sales, Chicago District.

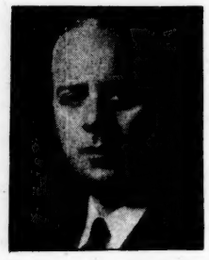
Fairbanks-Morse Co., 600 S. Michigan Ave., Chicago, has opened a permanent display of its products, including air conditioners, coal burners, pumps and diesel engines in its new building at that address.

Hubbell Corp., Chicago, announces the addition to its staff of *L. J. Picher* who will head up special sales and engineering activities.

Jones & Laughlin Steel Corp., Pittsburgh, has appointed three assistant general managers of sales: *R. T. Rowles* and *W. H. Wiewel*, supervising products sales departments, and *H. J. Watt*, supervising eastern district sales. A new district sales office has been opened in Baltimore in charge of *V. A. Jevon*, district sales manager, and *H. R. Dorney*, assistant district sales manager. *John B. DeWolf* has been named Philadelphia district sales manager, and *Edward H. Hughes* St. Louis district sales manager.

Lewis M. Parsons

Jones & Laughlin Steel Corp., Pittsburgh, has elected *Lewis M. Parsons* vice-president in charge of sales and a director. Formerly associated with Bethlehem Steel Co., Mr. Parsons was made assistant manager of sales of Bethlehem's Philadelphia office in 1932, and manager of sales in 1936.



L. T. M. Ralston

Kelvinator Div., Nash-Kelvinator Corp., Detroit, has appointed *L. T. M. Ralston*, formerly eastern divisional manager, to head its new national user sales department in New York. The new department will provide a central source for all engineering contact, installation and billing on sales of standard commercial and air conditioning products to chain stores and similar business of national scope.

The Miller Co., Meriden Conn., has appointed *O. R. Perkins* manager of its gas and oil division.

National Radiator Corp., Johnstown, Pa., has named *Joseph T. Ellis* manager of its oil heating division. Mr. Ellis in addition will continue as manager of the steel boiler division.

Pierce Butler Radiator Corp., Syracuse, N. Y., has appointed *William G. Miller* Pittsburgh branch manager, and *Floyd Adams*, formerly Richmond branch manager, has been named southern district manager with headquarters at 1729 Summit Ave., Richmond, Va.

The Rudy Furnace Co., Dowagiac, Mich., held its 5th annual dealer engineering clinic March 7-8 in the Oliver Hotel, South Bend, Ind. Three hundred attended. An extensive program covering servicing for automatic heat jobs occupied a major portion of the meeting.

Simplex Oil Heating Corp., New York, has moved to *21 West St.*

The Trane Co., La Crosse, Wis., has appointed *The Air Conditioning Corporation of Des Moines*, Iowa, as a dealer handling its air conditioning equipment.

Utilities Engineering Institute, Chicago, has leased additional office space to provide for expansion of its engineering department. The engineering staff will now be segregated from other departments of the Institute.

Westinghouse Electric & Manufacturing Co., E. Pittsburgh, Pa., has elected *George H. Bucher*, formerly executive vice-president, president of the company. *Frank A. Merrick*, president since 1929, was elected vice-chairman.

Westinghouse Electric & Manufacturing Co., E. Pittsburgh, Pa., is planning to construct new manufacturing and warehouse facilities at its E. Springfield, Mass., works. Some manufacturing operations will be transferred here from the Chicopee Falls, Mass., works. Room cooler units will also be manufactured here. The new manufacturing building will have approximately 100,000 sq. ft. of floor space, while the two-story warehouse will include approximately 230,000 sq. ft. of storage space.

Wheeling Steel Corp., Wheeling, W. Va., has appointed *K. P. Fuhrmann* manager of its newly created barrel and range division, with offices in Portsmouth, Ohio.

White-Rodgers Electric Co., St. Louis, has appointed *Frank Fillo* sales engineer. Mr. Fillo has been associated with Minneapolis-Honeywell for the past 14 years, the last four in the capacity of district manager in St. Louis.

COMING EVENTS

MAY 11-12, 1938. Annual Meeting, Refrigerating Machinery Association, Hot Springs, Va.

MAY 13-14, 1938. Annual Meeting, Air Conditioning Manufacturers' Association, Hot Springs, Va.

MAY 17-20, 1938. Annual Convention and Exhibition, Smoke Prevention Association, Andrew Jackson Hotel, Nashville, Tenn. Association headquarters, 139 N. Clark St., Chicago.

MAY 25-27, 1938. Annual Convention, Association of Gas Appliance and Equipment Manufacturers, The Greenbrier, White Sulphur Springs, W. Va.

MAY 31-JUNE 2, 1938. 49th Annual Convention, Heating, Piping and Air Conditioning Contractors National Association, Hotel Statler, Boston, Mass.

JUNE 13-15, 1938. Mid-Year Convention, National Warm Air Heating and Air Conditioning Association, Plankinton Hotel, Milwaukee, Wis.

JUNE 16-17, 1938. Annual Meeting, Stoker Manufacturers Association, Homestead Hotel, Hot Springs, Va. Chairman Convention Committee—J. E. Martin, Link-Belt Co., Chicago.

JUNE 19-21, 1938. 25th Summer Meeting, American Society of Refrigerating Engineers, The Pennsylvania State College, State College, Pa. Headquarters, Nittany Lion Inn.

JUNE 20-22, 1938. Semi-Annual Meeting, American Society of Heating and Ventilating Engineers, The Homestead, Hot Springs, Va.

JUNE 20-23, 1938. 31st Annual Convention, National Association of Building Owners and Managers, Hotel Schroeder, Milwaukee, Wis. Association headquarters, 134 S. LaSalle St., Chicago.

JUNE 28-JULY 1, 1938. Annual Convention and Manufacturers' Exhibit, National District Heating Association, Lord Baltimore Hotel, Baltimore, Md. Wm. H. Sanford, Secretary-Treasurer, NDHA, 1317 Spruce St., Philadelphia, Pa.

NO FIRE HAZARD HERE!

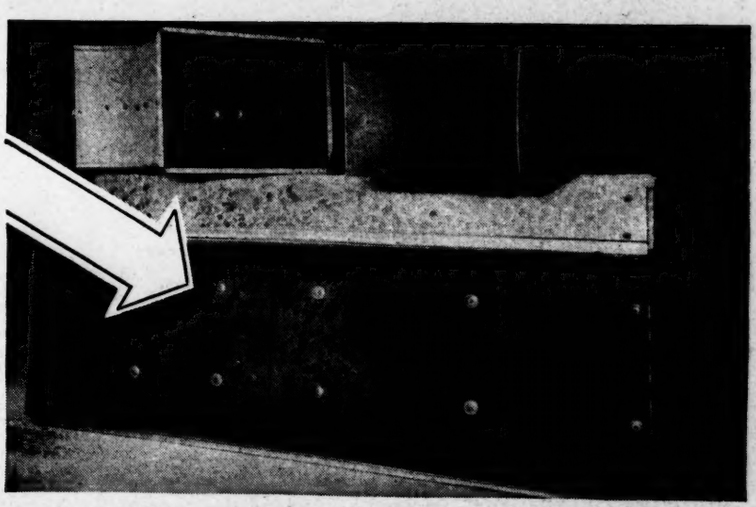
SERIOUS LOSSES have been reported in buildings where combustible sound absorbents—used to line air-conditioning ducts—have caught fire*.

The use of Johns-Manville Airacoustic Sheets for duct lining permanently eliminates this costly, unnecessary threat. Not only do these sheets provide as high as 80% sound absorption —but also, *they cannot burn or smolder. Can never contribute to fire spread.*

Furthermore, J-M Airacoustic Sheets are mineral in character . . . hence, permanent. Highly resistant to moisture . . . a serious enemy to the life of any material used in air-conditioning equipment. Light in weight, they are easily handled, quickly applied. Thermal conductivity is low; transverse strength high. And being smooth-surfaced—Airacoustic Sheets have a low frictional resistance.

For complete data on J-M Airacoustic Sheets, write Johns-Manville, 22 East 40th Street, New York City.

* In our files are bulletins from The National Board of Fire Underwriters, reporting several cases of this very nature.



Johns-Manville
AIR ACOUSTIC SHEETS FOR DUCT LINING